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THE AMERICAN GAS LIGHT JOURNAL

REDMAN & KENNY, N.Y.

PUBLISHING OFFICE No. 42 PINE STREET

DEVOTED TO THE INTERESTS OF ILLUMINATION, HEATING, MECHANICAL, CHEMICAL AND GENERAL SCIENCE.

VOLUME LXXXI. No. 15. Whole No. 1,531. | NEW YORK, MONDAY, OCTOBER 10, 1904. | $3 PER ANNUM, IN ADVANCE.

A. M. CALLENDER & CO., Proprietors. C. E. SANDERSON, Manager. THOMAS J. CUNNINGHAM and ELBERT P. CALLENDER, Editors.

ENTERED AT THE POST OFFICE AT NEW YORK, N. Y., AS SECOND-CLASS MATTER.

Published on each Monday of the year, at No. 42 Pine Street, New York.

Telephone.—2996 John.

Terms of Subscription, Including Postage.—For the United States and Canada, $3 per annum. European countries, $5 (£1—25 francs). All payments to be made in advance. Single copies, 10 cents.

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The Public Lighting Tables of the American Meter Company will be found in the page advertisement of that Company.

CONTENTS.

An Asterisk (*) denotes an illustrated article.

OFFICIAL NOTICES—

Where to Find the Western Gas Association's Exhibit and the Custodian Thereof at the World's Fair 561

Thirty-second Annual Meeting, American Gas Light Association. 561

EDITORIALS—

Briefly Told 562

Some Random Notes from the World's Fair—The Exhibit of the Gas Light and Coke Company, London, England—The Washington Meeting of the American Gas Light Association—Notes.

*Temperature as Applied to the Production and Purification of Coal Gas, by Mr. V. F. Dewey 563

Commercial Lighting, by Mr. Royal Shacklette 566

*The Formation of Naphthaline in Coal Gas, by Messrs. White and Ball 566

Acetylene from a Business Standpoint, by Mr. A. Davis 571

ITEMS OF INTEREST FROM VARIOUS LOCALITIES 572

A Queer Phase at Wilmington, Del.—Perhaps Something May Come from Cuba—The Davenport (Ia.) Company Wins—Changes at Terre Haute, Ind.—The Moses Man is Heard From—A Fair Settlement—An Old Story—Some Advice from Mr. Goodnow—Amherst, Mass., Selects Its Management—The Central Labor Union, of Boston, Tries Again—Officers of the Pacific Coast Gas Association—Changes at Clinton, Mass.—And Other Items.

Report of the President of the Pacific Coast Gas Association (Mr. W. A. Aldrich) Respecting His Attendance at the Gas Congress, St. Louis 573

The Market for Gas Securities 574

[OFFICIAL NOTICE.]

Where to Find the Western Gas Association's Exhibit, and the Custodian Thereof, at the World's Fair.

To the Fraternity: The exhibit of the Western Gas Association, at the World's Fair, St. Louis, is located in Section 33A, Liberal Arts Building, where Mr. Fred. R. Persons, who is in charge of the same, will always be on hand to receive visitors and to explain anything that requires explaining.

[OFFICIAL NOTICE.]

Thirty-Second Annual Meeting, American Gas Light Association.

AMERICAN GAS LIGHT ASSOCIATION,
OFFICE OF THE SECRETARY,
NEW YORK CITY, Sept. 14, 1904.

General Announcement.—There will be an annual meeting of the American Gas Light Association held at Washington, D. C., October 19th to 21st, 1904. The meeting will be called to order by the President, Rollin Norris, of Philadelphia, Pa., at 10 A.M., on Wednesday, Oct. 19.

The meeting hall will be on the tenth floor of the New Willard Hotel. The headquarters will be at the New Willard Hotel, 14th and F streets, Washington, D. C.

The most satisfactory quarters are always obtained by writing in advance to the hotel people, and in doing so a reply should be requested, for which a self-addressed stamped envelope should be inclosed, as misunderstandings may thereby be averted.

The New Willard Hotel is conducted solely on the European plan, and the rates for rooms will be as follows: Rooms without bath, $2.50 per day and upwards; rooms with bath, $3.50 per day and upwards. Double rooms without bath, $4 per day and upwards; double rooms with bath, $5 per day and upwards.

As the meeting room is in the hotel, it is hoped that all will make their headquarters at this hotel. There are, however, other hotels in the vicinity.

The roll call will be made by means of the door card system. Each member upon entering the hall for the first time will, at the door, receive a special card upon which he will find his name, address, etc., as it appears on the Secretary's books, and such card should be corrected and given to the doorkeeper. Members in attendance should attend to this very carefully, as these cards are used immediately after the meeting for correcting the annual membership list. Visitors will please hand to the doorkeeper their personal cards. A blank form of application for membership accompanies this circular. More can be obtained of the Secretary.

Remember, all applications must be in the hands of the Secretary by October 10th at the very latest, otherwise they will not be acted upon at this meeting.

The list of papers to be read at the meeting is as follows:

"Generation of Steam by Waste Heat from Water Gas Sets," by Donald McDonald, Louisville, Ky.

"Distributing Power Throughout a Gas Works by Means of Electricity Generated at a Central Point," by W. A. Baehr, St. Louis, Mo.

"Oxide Purification," by E. H. Earnshaw, Philadelphia, Pa.

"Methods of Charging for Gas," by F. W. Frueauff, Denver, Col.

"Consumers' Meters," by B. H. Spangenberg, Philadelphia, Pa.

"A Rapid Method for the Determination of Total Sulphur in Gas," by Mr. W. B. Calkins, St. Louis, Mo.

There will also be discussions on subjects connected with coal gas manufacture.

All members attending the meeting are particularly requested to wear their membership badges in plain sight, thereby greatly aiding the officers and the local committee in their work, by affording a ready means of recognition.

In order that the year book containing the report of this meeting may be published and issued to the members immediately after the meeting, notice is hereby given that if any of the speakers at this meeting desire to correct their remarks before they are printed, they will be given an opportunity before leaving Washington, but not after. The stenographer will have typewritten copy of the principal discussions prepared at the headquarters between the sessions of the meeting, and all those who desire to correct their remarks must notify the Secretary at the close of the session at which such remarks are made, as all the reports will be turned in to the printer immediately after the adjournment of the meeting.

Special.—As Washington is a very interesting city, it has been decided to have no entertainment on Wednesday night—leaving the members free at that time. There will, however, be a banquet on Thursday evening, and a steamboat excursion to Mount Vernon on Friday with luncheon.

For the ladies there will be on Thursday a trip around Washington in automobiles, and the Mount Vernon trip on Friday.

There will probably be a theater party for the ladies on Thursday evening, as the banquet will be for the men exclusively.

The price of tickets, including a seat at the banquet and the trip to Mount Vernon for the purchaser, and an automobile trip, luncheon and theater ticket for one lady, will be $5. Extra tickets will be sold for ladies for the automobile trip, luncheon, theater and Mount Vernon trip.

A. E. Forstall, Secretary.

BRIEFLY TOLD.

Some Random Notes from the World's Fair.—No. V.—World's Fair, St. Louis, Mo., Oct. 2d: Dear Journal: The register of visitors at the Western Association's exhibit here for the week ended yesterday shows the following names: O. N. Guldlin, Fort Wayne, Ind.; E. C. Benton, Chester, Pa.; J. H. Walker, Milwaukee, Wis.; P. W. Sampson, Elyria, O.; H. B. Montague, Southbridge, Mass.; Charles E. Baltey, Hastings, England; Austin Burt, Waterloo, Ia.; E. B. Skinner, Madison, Wis.; R. O. Thompson, Melbourne, Australia; F. W. French, Defiance, O.; Royal Shacklette, Adrian, Mich.; J. B. Klumpf, Philadelphia, Pa.; Frank Talbot, Birmingham, England; Fred. Talbot, St. Louis, Mo. The fraternity have not been very much in evidence this week, but the rapidly shortening hours of daylight afford our product a working chance to shine visibly. The general arrangements for illumination, on electric (for that matter on any other) account, are not of the best. Just now gas is the thing; just as it has been in the real working lighting field for years that are gone, and as it will be likewise for years to come. The Southern Railway Company has arranged with us for sleeping cars direct from here to Washington, D. C., for the better accommodation of delegates from here and points East who propose attending the sessions of the American Gas Light Association next week. Those desiring to avail themselves of the special accommodations should advise me immediately.—Fred. R. Persons.

The Exhibit of the Gas Light and Coke Company, London, England.—"Exhibit No. 64, in the Palace of Liberal Arts, St. Louis World's Fair, is one of magnitude and interest to the gas man. It is that shown by the Gas Light and Coke Company, of London, England, and it is well worthy of that huge corporation which for so many years has shown the world what gas can do. The exhibit is housed in a glass case, 7 feet high, and about 8 feet square on the floor. The trademark of the Company is a balloon carrying the word 'Beckton.' This trademark is suspended from the center of the case, and bears the inscription, 'Gas, Beckton; 20 thousand million feet.' The case, which is a marvel of artistic construction, carries four suspended glass shelves to hold the jars and bottles used to display the residuals that the Company prepares and puts on the market. Some of the figures given will open the eyes of the average gas engineer of America. Directly below the balloon in the case is a piece of gas coal labeled: Coal, 2 million tons used annually; coke, 1¼ million tons annual make; tar, 20 million gallons annual make; creosote, 4 million gallons annual make; pitch, 75 thousand tons annual make; benzol and naphtha, ¼ million gallons annual make; prussiate of potash, 1,500 tons annual make; sulphate of ammonia, 20,000 tons annual make; liquid ammonia, 880 tierces annual make; ammonia and liquor, 50 million gallons annual make; anthracine, 600 tons annual make; cyanogen liquor, 9 million gallons. I believe an inventory of the case would be of interest to your readers and will give it from the labels as they appear therein: Muriate of ammonia, refined white; muriate of ammonia, ordinary galvanizing, calico printing; nitrate of ammonia for nitrous oxide gas explosions; sulphate of ammonia for artificial manures and ammonia soda processes; naphthaline shackles; muriate of ammonia; 'dog tooth' crystals; naphthaline powder; anthracine, 80 per cent., 90 per cent., 98 per cent.; phenanthrene; di-nitro benzol; naphthaline, rock; creosote salts; alizarine; disinfecting powder, 15 per cent. carbolic; prussiate of soda crystals; naphthaline, candle 'Lang;' naphthaline, ordinary; naphthaline, purified for candle making, melting point 80°.

"*Sulphur.*—Ordinary prussian blue, lump, light shade; special bronze, prussian blue, lump, dark shade; ordinary bronze, prussian blue, lump, dark shade; special bronze, prussian blue, powder, light shade; special bronze, prussian blue, paste, 40 per cent., for paper staining; special bronze, prussian blue, powder, dark shade; ordinary prussian blue powder, light shade; ordinary prussian blue powder, dark shade; ordinary prussian blue, lump, dark shade; cyanogen purple, lump, ammonium chloride, crystals; prussiate of soda, granular crystals; prussiate of soda, crystals; prussiate of potash, granular crystals; carbonate of ammonia; red prussiate of potash; ferrous sulphate, No. 1; a special bronze, prussian blue, lump, light shade; a special bronze, prussian blue, lump, dark shade for printing ink; soluble bronze, prussian blue, lump, dark shade; sodium cyanide for gold extracting; potassium cyanide for gold extracting, etc. Also, aniline salts, carbazole and alizarine." Perhaps I have named sufficient of the case's contents to show how thorough is the display of residuals, but I could name more than a score before the list was completed. It is a great exhibit.—Fred. R. Persons.

The Washington Meeting of the American Gas Light Association.—Next week the American Gas Light Association will have attained "its majority," in that its 33d degree in fraternal gas work will be recorded on its records. Place for holding the meeting at this time of year cannot be excelled, for Washington in October, and even well into November, is noted for the comfort of its climatic condition. Meeting hall and headquarters have been secured under one roof, and as that roof covers the new Hotel Willard, no one need fear that the technical sessions will be marred by inharmony of sound and seating, or that the living availabilities will not be up to the right mark. Secretary Forstall's official notice gives all the details necessary for the guidance of those who will participate in the convention. The attendance promises to be excellent, and it is expected that a large contingent from the West will be on hand, if one may judge from the fact that Mr. Fred. R. Persons has arranged with the Southern Railroad for a special car service from St. Louis to Washington, which plan originated from the knowledge that at least a score of gas men connected with the several exhibits of gas apparatus at the World's Fair desire to attend the American's taking on its 33d year of work.

Notes——

Mr. J. T. Clark, Vice-President of the Excelsior Coke and Gas Company, of Topeka, Kas., is our authority for the statement that, now the contract giving the Company an adequate new lease of life has been signed, the works will be looked after in shape to fit them for the demands of the residents. This result would have been reached two years ago were it not for the the untractableness of the Topeka municipal directors.

The Monadnock Mills Corporation, of Claremont, N. H., has authorized the Logan Iron Works, Brooklyn, N. Y., to construct for it a holder up to retaining 50,000 cubic feet.

Captain John W. Hall, for many years prominent in the affairs of the Consolidated Gas Company, of Baltimore, Md., during which time he served it as President for several terms, died at his home in Baltimore, the morning of September 22d. He was in his 79th year, having been born in Baltimore, August 16, 1826.

Temperature as Applied to the Production and Purification of Coal Gas.

[A paper read by MR. V. F. DEWEY, Assistant Superintendent Detroit City Gas Company, at the Twelfth Annual Meeting, Michigan Gas Association.]

As a preface to this paper, I wish to express my appreciation of the valuable assistance rendered me by Messrs. G. W. McKee, Donald Davidson, Otis A. Sensel and F. G. Remington, all of the Detroit City Gas Company.

Any discussion of the assigned subject involves several varying factors, principal of which is the grade with kind of coal. I have consequently selected as the standard coal for examination the ¾-inch screened Youghiogheny gas coal, not because I think it the best coal but because of its extensive use.

The apparatus used in the tests is as follows: Sixty-inch LeChatelier, 10 per cent. rhodium platinum, thermo-couple with Siemens and Halske pyrometer voltmeter. Standpipe of one retort connected by means of 4-inch pipe and a piece of 6-inch pipe to a drum station meter. The 4-inch pipe was 20 feet long and arranged so that a spray of water could be turned inside same for purpose of cooling gas. The 6-inch pipe was filled with excelsior to prevent tar reaching the meter. The gas was drawn from the retort by means of a steam-jet exhauster placed at outlet of meter; a pressure gauge reading to $\frac{1}{100}$ of an inch was attached to the meter casing. The mouthpiece lid was tapped in two places, one for admitting the thermo-couple, the other for making connections by means of rubber tubing to pressure gauge on meter, thus permitting operator to keep pressure on retort practically constant. From 2 to 3-tenths of an inch was maintained throughout tests. See sketch for arrangement of apparatus.

The thermo-couple extended into the retort from the lid only 44 inches, or 30 inches inside of the end of retort, consequently the temperature readings would be lower than the actual temperature of the retort in middle and back end. The gas samples for analysis were taken from the top of standpipe. The ammonia was determined by regular standpipe tests, gas being drawn off at top of standpipe. Ammonia tests were taken continuously one each hour. Gas samples for analysis were taken every half hour, the first sample in each case being taken about 10 minutes after test was started. Data on the following things were determined:

1. Comparative temperature of carbonization.
2. Yield of gas at different heats.
3. Production of gas during the charge.
4. Yield of ammonia at different heats.
5. Production of ammonia during the charge.
6. Analysis of gas at different periods during charge showing change in chemical composition of gas.
7. Production of coke at different heats.

No information was gained regarding the production of tar owing to the inability to collect the amount made.

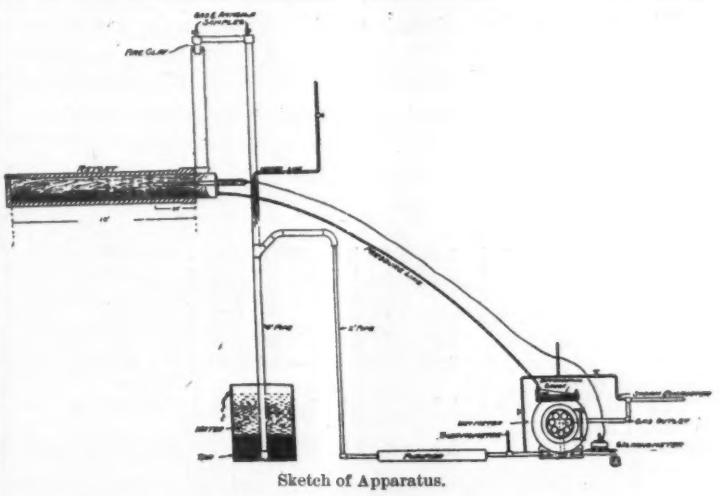
Tables Nos. 1, 2, 3 and 4 are analyses of gases produced at different periods of charge and temperature at the time sample was taken.

TABLE I.—*Analysis of Gases Produced.—Charge No. II.*

Hr.	H_2S	CO_2	O_2	C_nH_{2n} and C_nH_{2n-6}	CO	CH_4	H_2	N_2	Temp.
1	1.2	1.0	0.2	8.9	7.9	49.9	30.6	0.3	610° C.
2	0.8	1.6	0.5	5.5	7.7	45.8	35.2	2.9	660° C.
3	0.7	0.8	0.3	3.2	7.4	36.6	45.4	5.6	705° C.
4	0.2	0.2	0.5	0.5	6.8	26.3	60.9	4.6	670° C.
5	0.0	0.3	0.2	0.3	6.2	19.8	63.1	10.1	700° C.
6	0.0	0.0	0.2	0.1	6.9	12.2	69.1	11.5	700° C.
6½	0.0	0.6	0.2	0.0	7.4	8.2	68.3	15.3	700° C.

TABLE II.—*Analyses of Gases Produced.—Charge No. III.*

Hr.	H_2S	CO_2	O_2	C_nH_{2n} and C_nH_{2n-6}	CO	CH_4	H_2	N_2	Temp.
1	0.8	1.6	0.3	11.4	6.1	59.8	16.1	3.9	590° C.
2	1.0	1.0	0.4	7.2	6.9	48.3	30.8	4.4	640° C.
3	0.7	0.8	0.3	5.1	6.6	42.8	40.2	3.5	665° C.
4	1.1	0.9	0.3	3.9	6.4	39.9	41.0	6.5	690° C.
5	0.4	0.6	0.2	1.6	5.7	32.5	52.8	6.4	705° C.
6	0.2	0.6	0.1	0.1	4.4	10.7	74.2	9.7	710° C.
7	0.2	0.3	0.1	0.0	5.4	7.1	72.5	14.4	715° C.



Sketch of Apparatus.

TABLE III.—*Analyses of Gases Produced.—Charge IV.*

Hr.	H_2S	CO_2	O_2	C_nH_{2n} and C_nH_{2n-6}	CO	CH_4	H_2	N_2	Temp.
1	0.9	1.4	0.5	8.6	8.7	49.6	23.0	7.3	650° C.
2	1.2	1.0	0.2	6.1	8.4	40.1	36.2	6.8	650° C.
3	0.7	0.7	0.2	2.0	7.3	30.8	54.2	4.1	700° C.
4	0.2	0.1	0.0	0.0	5.1	10.4	76.6	7.6	740° C.
4½	0.0	0.3	0.1	0.0	11.2	5.9	68.9	13.6	740° C.

TABLE IV.—*Analyses of Gases Produced.—Charge V.*

Hr.	H_2S	CO_2	O_2	C_nH_{2n} and C_nH_{2n-6}	CO	CH_4	H_2	N_2	Temp.
1	.4	.8	.1	8.0	8.5	46.3	31.3	4.6	660° C.
2	0.5	.9	.2	6.9	8.3	44.2	34.2	4.8	760° C.
3	0.4	0.8	0.0	3.1	8.0	30.2	51.5	6.0	780° C.
4	0.0	.4	0.0	0.0	10.2	6.0	67.6	15.8	800° C.

Table No. 5 shows analyses of coke oven gas produced at different hours during carbonization.

TABLE V.—*Gas Analyses.*

Hours after Charging.	1	2	4	6	8	10	13	16	19	22	25
Illumin'nts	6.6	6.7	5.6	5.0	4.4	4.0	2.8	2.1	1.0	0.5	0.1
Marsh gas	42.7	38.6	35.6	33.7	33.4	33.7	30.8	28.7	20.7	17.6	14.1
Hydrogen	32.6	35.2	41.6	44.5	42.2	42.6	48.2	52.4	62.7	64.2	63.6
Carbon monoxide	8.2	8.0	8.2	8.2	8.4	7.9	8.9	8.8	8.2	9.3	10.0
Carbon dioxide	3.4	3.5	3.6	3.7	3.4	3.4	2.8	2.3	1.8	1.6	0.7
Oxygen ...	0.4	0.4	0.4	0.3	0.4	0.5	0.4	0.4	0.4	0.4	0.4
Nitrogen ..	6.1	7.6	5.0	4.6	7.8	7.9	6.1	5.3	5.2	6.4	11.1
.....	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0
Calorific val. B.H.U.	762.4	729.5	692.5	667.0	641.4	834.2	595.7	569.7	498.0	453.2	406.2
Junker's calorimeter	742.6	739.9	722.5	691.6	652.0	639.1	621.1	599.7	503.4	449.4	397.8

Table No. 6 shows the varying percentage of total production at different hours during charge of both gas and ammonia:

TABLE VI.—*Per Cent. of Total Gas and Ammonia Given Off Each Hour.*

	Charge No. 1.		Charge No. 2.		Charge No. 3.		Charge No. 4.		Charge No. 5.	
Hr.	Gas.	Amm.	Gas.	Amm.	Gas.	Amm.	Gas.	Amm.	Gas.	Amm.
1	35.2	27.7	26.1	16.4	17.5	14.6	31.2	23.6	35.1	34.3
2	23.6	27.8	26.3	23.3	17.0	18.7	28.3	32.3	30.8	34.3
3	17.3	21.0	25.1	35.1	16.9	20.5	25.7	29.1	27.5	26.7
4	16.8	17.3	13.0	16.2	16.9	20.2	13.8	14.1	6.4	4.7
							25 Minutes			
							1.0	.9		
5	6.3	5.3	7.0	8.0	15.7	14.7				
	45 Minutes		50 Minutes							
6	.8	.9	2.0	1.0	14.5	10.4				
7					1.5	.9				
	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0	100.0

TABLE VII.—*Comparative Results.*

Charge No.	No. Hours Carbonizing.	Heats, Color Test.	Temperature of Retort, Deg. C.	Amount of Coal Charged.	Pounds of Ammonia per ton of Coal.	Yield of Gas per Pound of Coal.	Per cent. of Coke from Coal.
No. 1	5½	....	660	170	2.44	2.67	76.47*
No. 2.....	6½	....	700	300	5.366	4.71	67.2
No. 3.....	7	....	715	410	5.434	4.76	64.1
No. 4.....	4½	....	810	352	4.98	5.06	64.48
No. 5.....	4	....	880	350	5.10	5.17	63.71
Coke oven...34		....	....	....	....	4.63	71.13

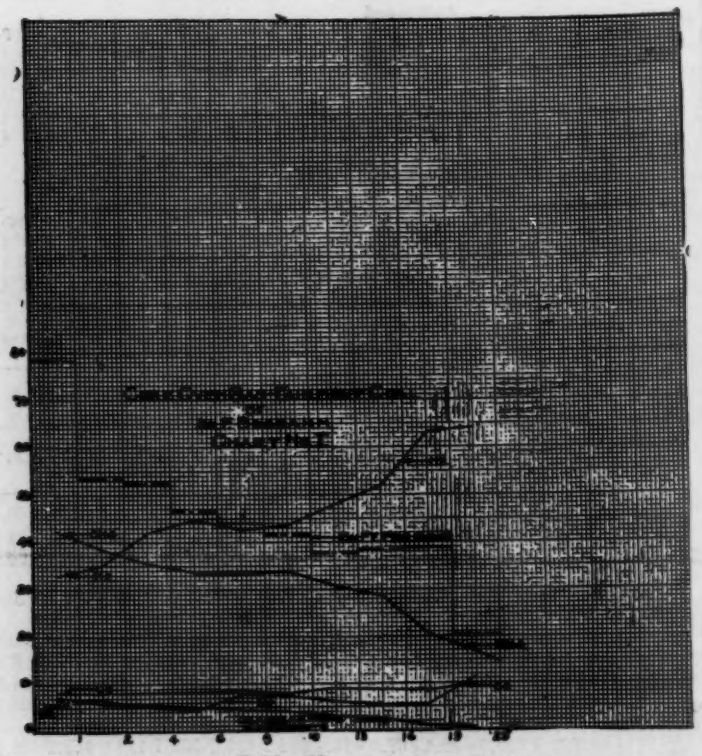
* Short retort, back half of retort blocked.

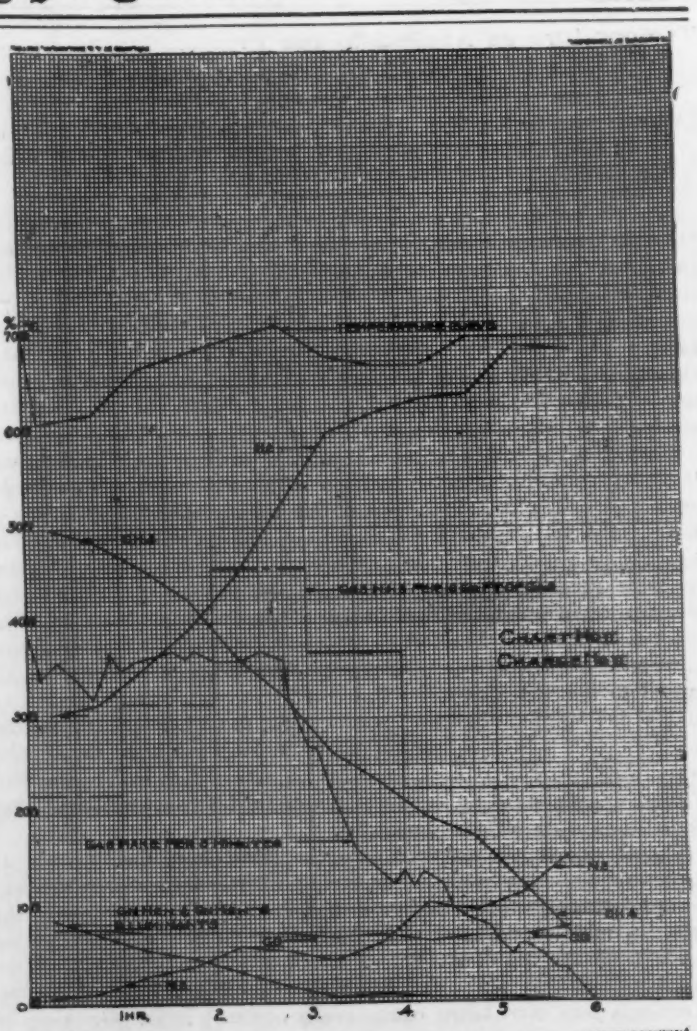
Table No. 8. Calculated analyses of average sample of total gases, also heat units calculated. The illuminants being taken as ethylene, heat value of gases: Ethylene; 1,603; CO, 320; H_2, 325; and CH_4, 1,024

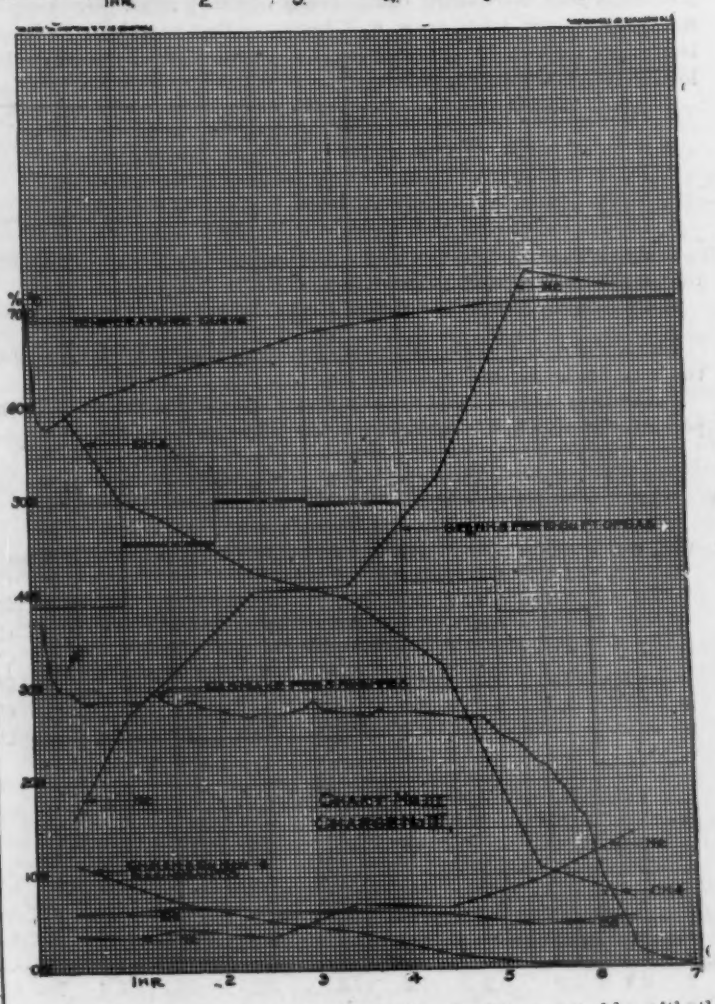
TABLE No. VIII.—*Analysis of Total Gases as Produced in*

	H_2S.	CO_2.	O.	C_nH_{2n} C_nH_{2n-6}	CO.	CH_4.	H_2.	N_2.	B.T.U. Gross per Cubic Foot.	Gross B.T.U. per Lb. of Coal.
Charge No. II.....	0.7	1.0	0.3	4.8	7.5	38 2	42.3	5.2	630.13	2968.0
Charge No. III....	0.7	0.9	0.3	4.8	6.0	39.4	41.6	6.2	637.00	3032.3
Charge No. IV....	0.8	1.0	0.3	4.8	7.7	36 5	42.6	6.3	611.57	3095.0
Charge No. V.....	0.4	0.8	0.1	5.6	8.4	38 5	40.2	6.0	642.2	3320.0
Oven gas. { rich..	....	3 6	0.3	5.2	6.1	38.7	38.4	7.7	625.58	....
Oven gas. { poo	....	2.2	0.3	2.4	6.3	29.2	50.5	9.1	522.50	....
Coal gas mfg. by D. C. G. Co. in 1900, 4 hr. charge	0.0	1.2	0.1	4.2	5.4	37.1	43.1	8.9	605.15	....
Coke oven gas....	....	2.2	0.3	3.8	6.3	33.9	44.5	9.9	574.47	2660 80

Chart No. 1 is a graphic representation of Table No. 5; and Charts



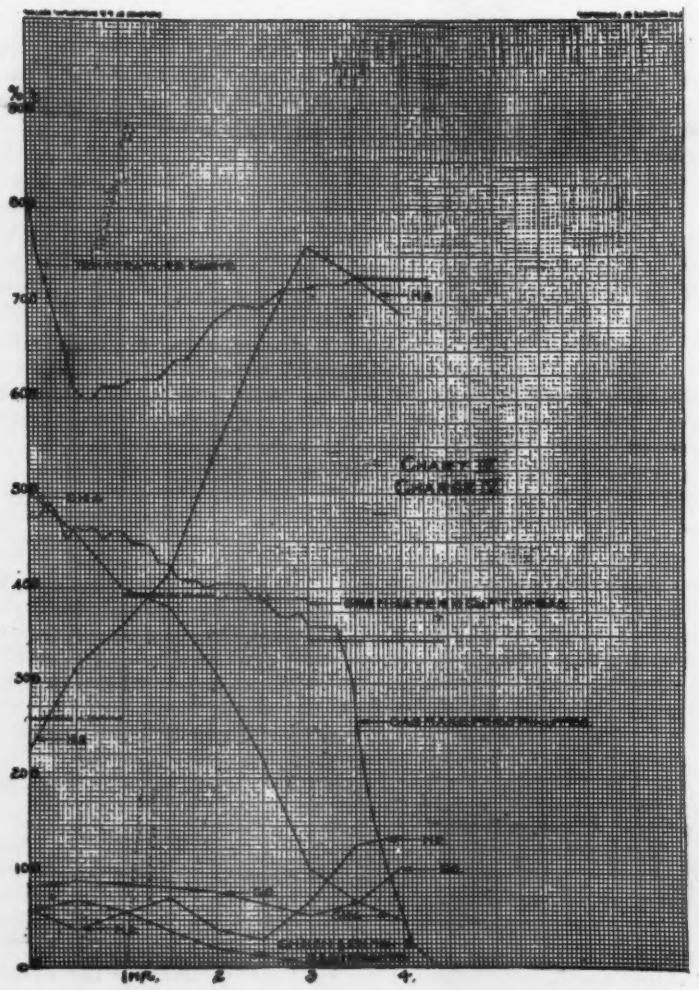


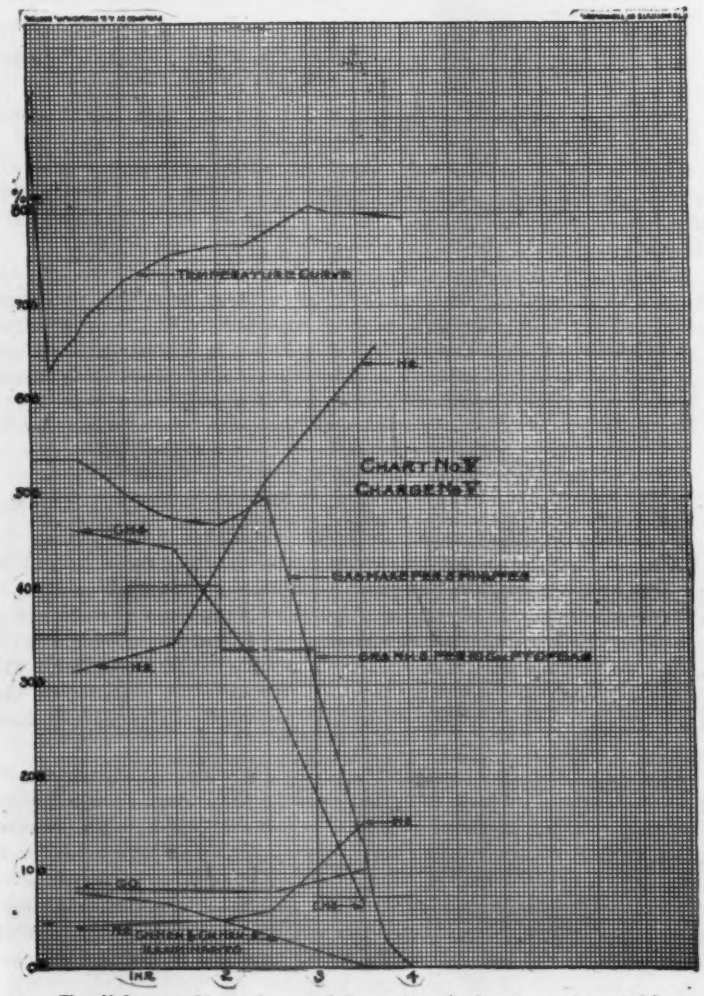


Nos. 2, 3, 4, 5 represent Tables Nos. 1, 2, 3, 4. In Charts Nos. 1, 2, 3, 4 and 5, figures to the left of initial line indicate per cent. when used in relation to analysis of gas. When used in relation to gas production they indicate cubic feet per 5 minutes. When used in relation to temperatures add cipher to the figures, thus indicating temperatures in degrees C. When used in relation to ammonia they indicate grains of ammonia produced hourly per 10 cubic feet of gas.

Naturally, considerable difficulty was experienced in getting every part of the apparatus working properly, consequently a number of tests were taken which were not satisfactory and have not been taken into account in the tabulation of the above data. The necessity of study along the lines indicated in the paper is emphasized by the fact that scarcely any authentic data could be found on the make and analysis of gas from American coals at different heats and at different periods during the charge, except some work done along this line by the by-product coke oven people. Every book along technical lines that refers to the gas business speaks entirely of English and Continental practice, and practically all the scientific data in them is gathered from the same sources. That there is a marked difference in the composition of the gas from English and American gas coals is shown at a glance when the two analyses are put side and side. This indicates a difference in the coal, and means that American coal gas practice cannot be along exactly the same lines as the English practice.

That there is a difference between the two practices is known to us all. Unfortunately, American coal gas practice has not settled down to a definite scientific basis along adopted lines. This will never come about until the scientific men in the gas business and in the universities turn their attention to this subject in earnest and settle the exact scientific treatment for each American coal and thereby place the manufacture of American coal gas on a scientific basis, comparable with the magnitude and importance of the business and on an even footing with





our English cousins. A careful study of the foregoing tables and charts reveals some very interesting results:

1. That a moderate heat gives a gas yield of about 4.8 cubic feet per pound of coal and a maximum yield of ammonia. That the heat units per foot of gas are high.

2. That high heats give a gas yield of from 5.1 to 5.2 cubic feet per pound of coal with a moderate amount of ammonia. That the heat units per foot of gas are practically the same as in a lower heat.

3. That as the yield increases the per cent. of coke produced slightly decreases.

4. That in 4-hour charging practically all of the gases are given off the first 3 hours and during that time the amount uniformly but slightly decreases until there is a rapid decrease in amount of gas produced.

5. Grains of ammonia produced per cubic feet of gas increase to a maximum in the middle of the carbonizing period.

6. The amount of gas and the amount of ammonia produced the last hour are small and the quality of gas very poor.

7. A coke oven gas plant, apart from its utility as a coke producer, is a poor method of transferring quantity and quality of gas, as compared with ordinary retort practice, to the consumer.

Unfortunately we were unable to take the make and quality of the tar produced, but quoting from English practice as described by Lunge, notice following table, showing that the higher the heat the greater the per cent. of pitch:

Temperature as Applied to the Production of Coal Gas.

Cubic feet gas yield per long ton of coal.....	6,600	7,200	8,900	10,162	11,700
Specific gravity of tar...	1.086	1.102	1.140	1.254	1.206
Composition of tar per cent. weight. Ammoniacal liquor.....	1.20	1.03	1.04	1.05	0.383
Crude naphtha.....	9.17	9.65	3 75	3.45	0.995
Light oil.....	10.50	7.46	4.47	2.59	0.567
Creosote oil.....	26.45	25.83	27.29	27.33	19.440
Anthracene oil	20.32	15.57	18.13	13.77	12.280
Pitch	28.89	38.80	41.80	47.67	64.080

Quoting again from same authority—"Tar product at 800° C. contains 15 per cent. free carbon, at 1,100° C. from 25 to 30 per cent. free carbon."

The grade with kind of coal has much to do with the amount of free carbon in tar.

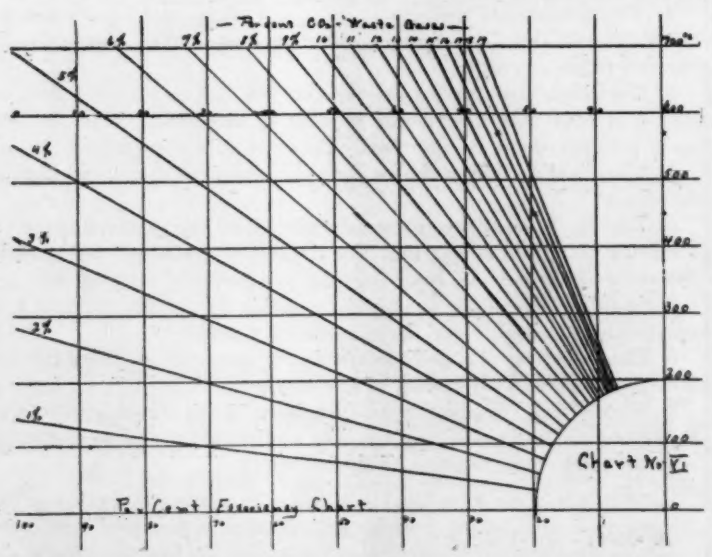
A West Virginia coal when subjected to high heats will yield a tar containing about 40 per cent. of free carbon, while the same coal carbonized at medium to low heats produces a tar containing about 20 to 25 per cent. free carbon.

The amount of naphthaline in tar increases as the heats are increased. The tar produced at medium heats undoubtedly has a higher value for every purpose than tar produced at high heats. Thus we come to the first question, "Shall we run high or low heats?"

Manifestly it depends upon local conditions. I will simply suggest a course of procedure. During the maximum demand for gas force your coal gas benches to their limit. As the demand for gas diminishes, gradually lower your heats rather than shut down benches and maintain high heats on remaining benches. The reason for this deduction is, a heat that will give a yield of 4.8 cubic feet per pound of coal, apart from the increased interest and depreciation charges, will produce gas at a slightly less net cost per 1,000 than gas produced at a very high heat. In other words, the differences in the residuals, furnace fuel and retort house labor per 1,000 more than make up for the increased yield per pound of coal at a high heat. As regards the difference in the amount of furnace fuel required to decarbonize at a high and low heat, a test was made in Detroit. The two benches selected for test purposes were side and side both in the same condition. The primary and secondary air slides were set very carefully, such that a maximum of CO_2 would be present in waste gases. Temperature and analysis of waste gases were taken frequently, at the same time the furnace fuel was weighed. It was found that the amount of furnace fuel consumed per ton of coal carbonized at a high heat was 8 per cent. more than at low heat. This corresponded very closely to efficiency results calculated from analysis and temperature of waste gases. Note chart VI.

I have included in this paper a per cent. efficiency chart, made by Bunte, which is copied from "Gas and Fuel Gas Analysis for Engineers," by Gill. From this chart, knowing per cent. CO_2 and temperature of waste gas, one can readily calculate the efficiency of any furnace or boiler.

In conclusion I wish to state that I realize that I have only touched



on the outer edge of the subject. The subject is so broad and inclusive that it demands furthur and expert study than I have been able to give, and I will be satisfied if I have instilled into some one the desire and purpose to take up the subject and thoroughly investigate it.

Commercial Lighting.

[A paper read by MR. ROYAL SHACKLETTE, Manager Adrian (Mich.) Gas Company, at the Twelfth Annual Meeting, Michigan Gas Association.]

Commercial lighting is now a subject of considerable importance to the gas man. In our pursuit of an ideal load curve, by way of the gas range, gas engine, special contract, etc., a great deal of this business has been left to our competitors which rightfully belongs to us.

As was recently asserted in an arc lamp prospectus, and fully substantiated by the compiled data of one of our large syndicates, commercial lighting is the "Cream of the business," requiring no main extensions, seldom a service, and quite often not even an extra meter; for most establishments regard gas service as necessary insurance against the freaks of the electric current and the vagaries of the patent gas machine. Right here let me say that, in my opinion, we would be much better off without a class of consumers who use gas only in an emergency, or as a last resort, as such service tends to convey the impression that gas is only a makeshift, and such installations are very liable to be equipped with old and decrepit chandeliers, broken or mismated globes, open tips, etc. Their presence will probably do more than anything else toward maintaining in the mind of the man who jumped from open tips to electric light and never got back to gas again the idea that it is a back number. A solicitor's first effort toward the securing of new business in such cases should be to get these appliances out of sight. Besides improving the general tone of the business, it is the first strong entering wedge in some instances, as it is impossible to talk gas arc or high power burner lighting with those old fixtures staring one out of countenance.

It is not enough te say that such and such a place is lighting with gas exclusively—it may be one of your best prospects. A merchant who a year ago had 3 gas arcs in his store and was advised to put in another, said he had all that he needed; but when some of his neighbors increased the number of lamps in use, he 'phoned to the office saying that he must have the best lighted store in the block, no matter what the cost, and ordered another in at once. For the same reason he later added 2 more, and now uses 6 instead of 3, and declares an abundance of light to be his most effective and cheapest advertising and a source of great satisfaction to him and his customers.

We have had the same experience with outside arcs, the first trouble being to get one up. After that is accomplished it is comparatively easy to prove to others in the block that they are a necessity to a well-established business concern.

High power burners are good and so are gas arcs, but neither should be worked to the exclusion of the other. As an instance, a company with which I am connected serves a small city in which there were only 3 gas arcs in use, but over 300 high power burners were sold in the past year, due largely to the activities of a burner agent. The company charged $10 each for the arcs and made no provision for their maintenance. The agent received $1.25 for the high power burners, though in all probability the gas company could not have sold the same number at $1 each in three times that period. He did good work for the company but did not bring in any new consumers. We announced a loan maintenance rate of 40 cents per arc, and contrary to the expressed opinion that we had all the commercial business obtainable, we took orders for 40 arcs within a period of 10 days. This was all new business, obtained at odd times by a solicitor while canvassing for ranges.

Location of Lamps.—In this we can well afford to take a lesson from the electrician, who usually gets his lamps as close to the ceiling as possible. Gas lamps, and especially the arcs, should where possible be hung out of range of the vision to avoid dazzling the eyes, and as high as possible to obtain more perfect diffusion. It is the clearness with which all surrounding objects may be seen, rather than the brilliancy of the light itself, that makes for a well lighted store or shop. Care must be taken to get them well up in the first instance as it may be difficult to convince your customer that he will get as good results by raising them.

The gas man, however, does not always meet ideal conditions as regards height of ceilings, arrangement of contents, location of drops, etc., and with these we must study to get the best results possible. It is of no use to put in a number of lights and then have them stand idle half of the time or be thrown out altogether, simply because of lack of judgment in their location. If the lights must be hung low induce the use of opal or tinted globes if possible, and if the drops are not properly located it is seldom that a proprietor will object to a short run of pipe, if it is neatly put up and carefully gilded or painted to match the ceiling.

Where conditions will permit, gas arcs should be hung 8 to 9 feet high, and single burners can sometimes be placed equally high. One of the best lighted places I ever saw is a barber shop where 4 Block lights are hung 8½ feet high from a 12 foot ceiling.

Present Needs.—The lighting appliance manufacturer has done wonders for us, but there are two things we need badly—a satisfactory form of ventilator for inclosed window lighting and a simple device for lighting and extinguishing lights in inaccessible places. The General Gas Light Company and the Welsbach Company both inform me that they have tried numbers of electrical devices, but have never been able to obtain a satisfactory one.

The Milwaukee Gas Company recently had made some lamps with an inverted by-pass, with valves above the ceiling plate, operated by cords and pulleys, which are proving satisfactory and more will be made.

The Racine (Wis.) Gas Company some time ago fitted up a skating rink with a separate line for the pilot lights, but as they have never been in active use it is not known how satisfactory the device would prove. One manufacturer is at present getting out an all steel, enameled arc for shop lighting, and a fancy design for churches, offices, etc., which will probably be on the market before this paper is read.

The Holophane Company have designed a very successful gas arc globe and are working on a special glass mixture by which they hope to obviate the heavy breakage in their glassware. With the constant improvement in appliances and ever broadening experience, the gas man should be able to secure and hold against all comers such of the commercial lighting business as he deems profitable.

The Formation of Naphthaline in Coal Gas.

[A paper prepared by MESSRS. ALFRED H. WHITE and S. BALL[1], and read at the Twelfth Annual Meeting, Michigan Gas Association.]

A careful review of all the accessible literature on the subject of naphthaline, a partial bibliography of which is appended, exhibits to the searcher the discouraging fact that there is not even a semblance of agreement among the various writers as to the ultimate causes of the stoppages in pipes which cause so much trouble to the gas maker. The discordant results of the many investigators warn the beginner on the subject that he must indeed go slowly and carefully and accept nothing without having first tested it himself.

In our study of the naphthaline question, of which this paper is a report of progress, we have accepted nothing as proven, except the one fact that in a gas works naphthaline is formed only at high temperatures such as obtain in the retorts. We believe that the evidence on this point is overwhelming. The literature records no proof whatever of the theory sometimes advanced that naphthaline is formed at ordinary temperatures, as in the street mains, and all our scientific knowledge leads to the belief that the entire naphthaline formation takes place in the retort or the water gas machine.

1. Mr. Ball is the holder of the Michigan Gas Association Gas Engineering Fellowship, University of Michigan.

For the purposes of study the naphthaline problem may be divided quite clearly into two fairly independent problems.

a. The formation of naphthaline in the retorts.

b. The removal of naphthaline from the gas after it leaves the retorts.

The investigation of the *formation* of naphthaline would demand control of the temperature and rate of heating of the retorts as well as ability to make a complete analysis of the products of combustion for naphthaline and such other products as seemed necessary.

The second problem—that of removal of the naphthaline from the gas—is simpler in that it does not involve the necessity for measuring retort temperature, but it involves the same necessity for analysis of the gas and tar that the first problem does, for the investigator must be able to determine the amount of naphthaline in the crude gas as it leaves the retort, and to follow it step by step as it is eliminated in the tar or separated in other forms.

The deficiency of these very necessary analytical methods was apparent from the start. Methods were known for the determination of naphthaline in purified gas, but it was speedily shown that they were not applicable to unpurified gas and still less adapted to determination of naphthaline in tar. The first work then was the development of these methods of analysis. As they were worked out, the knowledge gained was applied to study in the works so that the paper we have to present is divided into two parts.

Part I.—Methods of estimating naphthaline in crude gas and tar.

Part II.—The removal of naphthaline from crude gas.

I.—*Method of Estimating Naphthaline in Crude Gas and Tar.*—Küster[1] has given a method for estimating naphthaline which has been adapted by Coleman and Smith[2] to determination of naphthaline in purified illuminating gas. The method depends upon the property which naphthaline possesses of combining molecule for molecule with picric acid forming an insoluble compound. The gas is allowed to bubble slowly through a standard solution of picric acid. A yellow precipitate indicates the presence of naphthaline. The liquid and precipitate are put into a flask which is then exhausted, sealed and heated on a water bath. With small amounts of naphthaline the solution clears up on heating, but after cooling with frequent shaking the naphthaline picrate crystalizes out as a definite compound. After filtering, the uncombined picric acid may be measured by titration with barium hydroxide, and the naphthaline calculated. This method was tested by slowly drawing air through a weighed tube containing naphthaline and then through standard picric acid. The agreement between the loss of weight of the naphthaline tube and the naphthaline found in the picric acid is very good, as the following figures show :

Loss of Weight in Tube.	Naphthaline Found in Picric Acid.
41 mg.	40.9 mg.
27.2	25.5
18.8	19.3

The method, then, gave very satisfactory results with purified gas, but it failed with unpurified gas. The picric acid solution became dark red and the end reaction was obscure, due possibly to phenols. An attempt to extend the method to tar was still less successful. The solution of picric acid extracted considerable material from the tar, forming a flocculent precipitate; but it was entirely impossible to titrate the residual picric acid because of the tarry matters.

An attempt was then made to recover the naphthaline from the picrate and weigh it as pure naphthaline. After preliminary tests on pure naphthaline had shown that, barring necessary small losses, it was accurate, the method was adopted of repeatedly exhausting about 1 gram of tar with small portions of a saturated alcoholic solution of picric acid. The residue after extration was granular and consisted at least in part of picrates of anthracene and other more complex hydrocarbons. The solution of dark red color contained the picrate of naphthaline and other picrates soluble in alcoholic picric acid. If such an alcoholic solution be diluted with three volumes of a saturated water solution of picric acid, a large and flocculent precipitate will be formed which will consist in part of picric acid and in part of picrates of naphthaline and other compounds. If the solution is chilled in ice water the precipitation of the naphthaline is nearly complete and further addition of water or saturated aqueous solution of picric acid fails to cause a further precipitate. On the other hand the picrate of benzol is broken up completely in such aqueous solution, and the benzol remains in solution. The precipitate is transferred to a flask and an excess of strong caustic soda added which breaks up the picrates, liberating the hydrocarbons but combining with the phenols. If now air be drawn through this solution especially at a somewhat elevated temperature the naphthaline will be removed as vapor which may be chilled out and weighed. In practice the small flask with its alkaline solution was connected to a U-tube filled with quicklime and phosphoric anhydride to remove moisture and the whole placed in an air oven heated to 70° to 80° C. The outlet of the drying tube ran through the wall of the oven to another weighed U-tube immersed in a bath of ice water just outside in which the naphthaline was deposited. This method is capable of giving good results. By extracting 1 gram of tar four times with 25 cc. portions of alcoholic picric acid, the naphthaline may be completely brought into solution and separated from many of the heavier constituents of the tar. By the addition of a large amount of a water solution of picric acid the naphthaline is almost as completely precipitated as the picrate and separated from the benzol, while by treatment with alkali the phenols are retained and by drawing air through, the naphthaline is separated from the heavier hydrocarbons having no appreciable vapor tension. The naphthaline separates in the U-tube as beautiful, snow white crystals. The results by this method would be slightly low but should otherwise be correct, and experiments made on known amounts of naphthaline, mixed with benzol, phenols, naphthols and anthracene give satisfactory results. The only objection to the method was its cumbersomeness, and theoretical considerations and the work described further on in this paper on the vapor tension of naphthaline led to its satisfactory simplification.

The stability and inertness of naphthaline as a chemical compound makes it certain that it exists in tar purely in the dissolved state. Therefore, if air is bubbled slowly through tar, preferably warm, there will be a conflict between the tendency of the naphthaline and other compounds to remain dissolved in the tar and the tendency to pass off with the air as vapor. The result will be a compromise, each incoming bubble of air carrying away a portion at least of the naphthaline due to it, with the final result that practically all the naphthaline will be removed from the tar. At the same time other substances will be taken out by the air, notably benzol and the simpler hydrocarbons and phenols. If alkali is added to the tar or the vapors are passed over lime, the phenols will be retained and only the hydrocarbons will pass on. The air carrying these may be dried and the hydrocarbons condensed out in a U-tube immersed in ice water as before. By experiment it was found that it required from ¾ to 1 cubic foot of air to remove naphthaline from 1 gram of tar so completely that no further condensation occurred in a tube in ice water. This 1 foot of air, of course, passed out of the apparatus saturated at that low temperature with benzol, naphthaline, etc. At zero Centigrade 1 foot of air would contain from 3.5 to 4 grams of benzene vapor and as our sample of tar contained less than 1 per cent. of that amount it is apparent that no benzol would remain in the U-tube. On the other hand the amount of naphthaline required to saturate a cubic foot of air at that temperature is only about one milligram which amounts to 1 or 2 per cent. of the total amount in the tar. Therefore, under the most unfavorable circumstances, we should recover 98 per cent of the naphthaline. The deposit consists of the characteristic, snow-like crystals but as their melting point is nearly 10 degrees below that of pure naphthaline they are evidently contaminated with some other hydrocarbon. We have not had time to investigate the nature of this hydrocarbon, further than to show that it is not benzol. We hope to take the subject up later but have passed it over for the present, because viewed from the purely technical standpoint it makes no difference whether the crystals are pure naphthaline or not, for they have been isolated by methods similar to those which prevail when naphthaline stoppages occur in street mains, and if the deposit is not pure naphthaline the remainder of it consists of hydrocarbons closely related to it in properties and which will accompany the naphthaline and behave like it in the gas works. This simplified method gives results in good agreement with the more complicated picric acid method and we have used it in all our later work. The details of the working method are given below.

Details of Method for Estimation of Naphthaline in Tar.—About 1 gram of tar is weighed into an Erlenmeyer flask of about 50 cc. capacity which is closed with a double bored cork. One glass tube passing to the bottom of the flask serves as the air inlet and the other outlet tube tube connects with a U-tube of about 8-inch arms filled two-thirds of its length with fragments of quicklime and the last third with glass wool and phosphorus pentoxide. The whole apparatus is to be capable of being placed in an air oven with the tube leading away from the oven at a point where it may make immediate connection with a small weighed U-tube immersed in ice water. Unless this is a very close connection there will be some condensation of naphthaline before the U-tube is reached, but this deposit may be driven on into the U-tube by

1. Berichte V. 27, p. 1,101.
2. *Journal of Gas Lighting*, Vol. 75, p. 798 and Vol. 80, p. 1,277.

cautious heating. Rubber corks and rubber connections are to be avoided because of the tendency of rubber to absorb naphthaline. If it is necessary to make a rubber connection here it is advisable to fuse on to the arm of the condenser U-tube a short piece of glass tubing of a diameter large enough to slip over the tube from the oven like a sleeve and to make the rubber connection over that. In that way the naphthaline does not come in contact with the rubber.

After the apparatus is all in order about 1 gram of tar is weighed into the flask which may advantageously contain some fibrous asbestos to increase the surface of tar exposed to the air. The oven is then heated to 70° to 80° C. and dry air slowly drawn through, at a rate of about 2 liters an hour. After an hour crystals of naphthaline are abundant in the cold tube and also minute drops of benzol which soon begin to disappear. After 4 hours the first weighing is usually made, at which time there should be no drops of benzol or moisture in the tube. Weighings are repeated about every 2 hours until the gain in weight is less than a milligram on a 2 hours' run. If an abnormal increase is found toward the end of the experiment it is due to the drying tube being exhausted and failing to stop all the water. Towards the end the increase in weight becomes very slow, apparently because of the tendency of the lime dryer to hold very considerable quantities of naphthaline by absorption or some similar phenomenon. On this account, if it is necessary to renew an exhausted drying tube during a run, the new tube should be simply placed in series after the old one, so that the naphthaline held in the old tube may be recovered.

Method of Analysis of Crude Gas.—The estimation of naphthaline in crude gas involves precipitation of naphthaline as the picrate with subsequent recovery of the naphthaline as in the case of tar. Considerable care is necessary in sampling gases which contain tar, if it is desired to distinguish between the naphthaline actually present as vapor in the gas and that existing dissolved in the fine, mist-like particles of tar suspended in the gas and which will be removed later by mechanical scrubbing. It is out of the question to collect a tank of gas say from the foul main and transport it to the laboratory for examination. The condensation and separation of tarry products in the gasholder would nullify the value of the figures obtained. It is necessary to separate the suspended tar and remove the naphthaline before change of temperature has had time to alter the conditions prevailing at the point of sampling. This requires that the tar vapors shall be mechanically filtered from the gas without any change in temperature. The result is attained by inserting horizontally into the main a glass tube about ¾ inch in diameter, filled with glass wool or asbestos fiber. This tube should project into the main at least 6 inches and at as short a distance outside the main as possible should connect with the picric acid absorbing train, and then with a gasholder of about 1 cubic foot capacity and of known volume. The gasholder for this purpose may be a galvanized iron cylinder coned and provided with stopcocks at each end so that the water running out the bottom will provide the suction necessary to draw the gas from the main against the suction of the exhauster. The strong solvent power of tar for naphthaline, discussed later in this paper, renders it absolutely essential that the gas shall not be scrubbed by passing through cold tar, as would be the case if the tube for separation of the tar were placed outside the main, and, for example, connected to a pet cock.

This method of sampling is not an ideal one, because although there is no drop of temperature the gas is still brought much more thoroughly in contact with the hot tar than it would be in the hydraulic main for example, and the results would represent the amount of naphthaline which the tar would be incapable of extracting by contact with the gas at that temperature, rather than the conditions actually prevailing in the hydraulic main.

After the sample is collected the tar filtering tube is removed from inside the pipe, the gain in weight noted if desired, and the tar and asbestos transferred to a flask and the naphthaline estimated as before. The most convenient way to remove the tar to the volatilizing flask is to break the tube and place glass and all in the flask. The picric acid contains the naphthaline and tar which were still present in the gas as vapor. The solution and precipitate are washed into the volatilizing flask and treated with alkali to neutralize the picric acid. It is our custom to add here an excess of solid alkali, making an almost saturated solution when hot, merely to prevent so much moisture being carried into the drying tube. As this addition of solid alkali makes the solution hot, it should not be added until just before the apparatus is connected up, so as to avoid loss of naphthaline.

In this way it is possible to estimate the amount of mechanically suspended tar, the per cent. of naphthaline in it, and the amount of naphthaline present as vapor in the gas.

II.—*The Removal of Naphthaline from Crude Gas.*—As an appendix to this paper will be found a bibliography of the most important articles in English or German on the naphthaline question, with a few words indicating the nature of each one. A glance at them will reveal their conflicting nature, but some opinions are fairly common to all. All believe that it is necessary to cool the gas to remove naphthaline and the belief is general, although it is implied rather than expressed, that the gas leaves the condensers saturated with naphthaline—hence the need of keeping the condensers cold. There is, however, the widest divergence of opinion on the question whether one gas differs from another in its ability to "carry" naphthaline, and the influence of moisture, ammonia and benzol is much disputed. All these important points have received at least partial investigation and are dealt with in this paper under the heading "Vapor Tension of Naphthaline."

It is well known that most of the naphthaline separates out with the tar, and it seems to be the general belief that it separates out with the tar purely because the gas cools and throws out naphthaline and tar together. However, the efficiency of heavy oils for removing naphthaline has been widely recognized in recent years and more importance is being attached to the value of tar as a solvent for naphthaline. The experiments which we have made on this subject are given under the heading "Tests Made in Gas Works."

Vapor Tension of Naphthaline.—It is known that if we have a vessel filled with a mixture of different gases, each gas will take part in resisting the weight of the outside atmosphere in proportion to its per cent. by volume of the mixture. If we have a vessel filled with dry air and introduce some water, some of the water will be converted into vapor and exert a pressure proportional to its volume substantially like gas. Provided only that water enough is present and sufficient time is allowed, the pressure exerted thus by water vapor is independent of the size of the vessel, the nature of the gas in the vessel and the pressure in the vessel, but depends solely on the temperature. For any given temperature the pressure, the so called vapor tension, exerted by water vapor is constant. From this vapor tension may be calculated the weight of water in a cubic foot of air saturated with water vapor.

Similarly to water, every liquid and also every solid is supposed to have a definite vapor tension for every temperature, although in the case of very many solids and some liquids it is immeasurably small. The higher the temperature the more of the substance will assume the vapor form. If the temperature drop from a higher to a lower temperature some of the substance must be thrown out in the solid or liquid form.

Naphthaline owes its objectionable prominence in part to the fact that it has an unusually high vapor tension, and in part to its property of changing from the vapor to the solid state without passing through the customary liquid condition. Furthermore, it is deposited in the solid state as crystal flakes which are very beautiful but likewise take up space out of all proportion to their weight.

In a study of naphthaline deposition it is important to know how much naphthaline will be thrown out if a saturated gas is cooled, say from 120° F. to 100° F. A table of vapor tension covering all necessary temperatures has been experimentally determined by Allen,[1] who checked his work by two distinct methods. It was thought best to repeat his measurements however on account of the importance of the results for our purpose. This was done by two different methods. By one method gas or air was passed through a standard experimental meter, then through a drying train and through a number of Wolff bottles placed in a thermostat and containing sublimed naphthaline. The gas thus saturated with naphthaline at the temperature of the water bath passed into a standard picric acid solution in which the naphthaline was precipitated and estimated by titration. By the other method, which was similar to one of Allen, the gas from a carefully calibrated gasholder of a little less than a cubic foot capacity was passed through a drying train, and then into an air oven of carefully regulated temperature where the gas passed through two weighed tubes, filled with naphthaline and placed in series. The loss in weight gave the amount of naphthaline removed by the gas. Each U-tube was weighed separately and if the second tube had lost only a small amount in weight it was certain that the gas was being completely saturated as it passed through. It was necessary to pass the gas very slowly to accomplish this, some 20 hours being required for a cubic foot. Our results agreed with Allen's very closely as may be seen in Plate I. where are plotted the points of Allen's curve and our own. It will be seen that the two are in good agreement. Table I. gives the numerical results of our work in English units and No. II. in metric units.

1. *Journal of Society Chemical Industry*, 1900, p. 200. Also *Journal of Gas Lighting* Vol. 75, pp. 673, 1003.

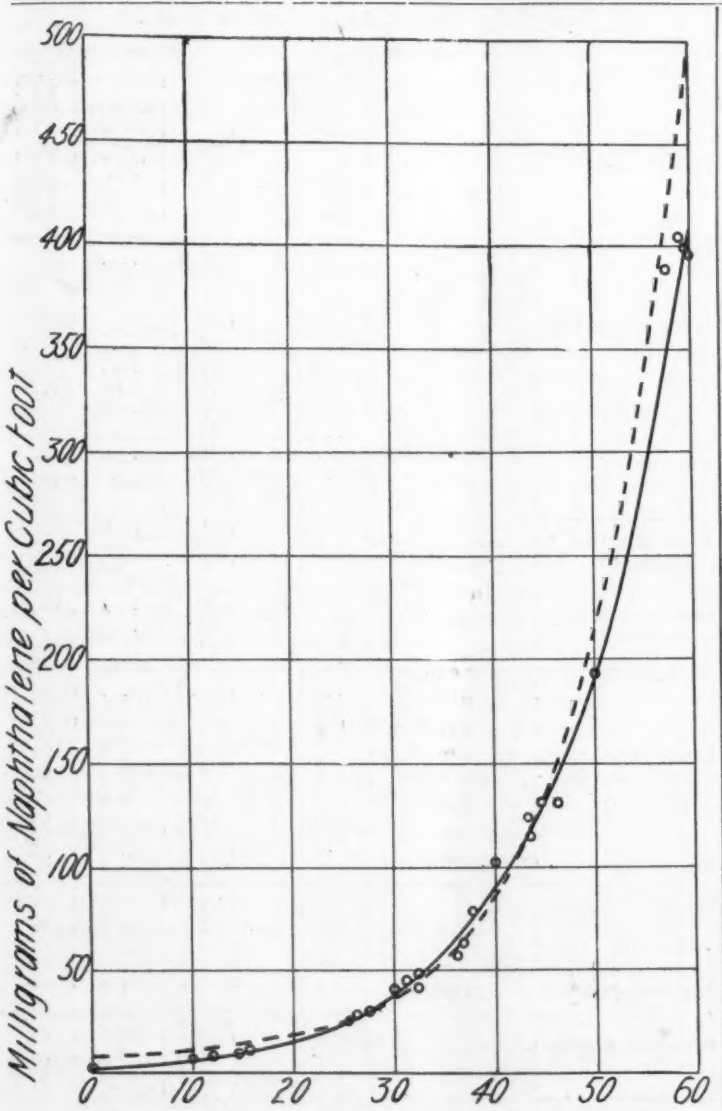


Plate I.

TABLE I.—*Weight of Naphthaline Required to Saturate a Cubic Foot of Gas at Various Temperatures, Fahrenheit.*

Degs. F.	Mg. Naphthaline. Per Cubic Feet.
32	0.5
40	2.2
50	4.5
60	8.4
70	15.5
80	27.3
90	46.0
100	75.8
110	118.0
120	179.0
130	262.0
140	408.0

TABLE II.—*Weight of Naphthaline Required to Saturate a Cubic Foot and a Cubic Meter of Gas at Various Temperatures, Centigrade.*

Degs. C.	Mg. Naphthaline Per Cubic Fe t.	Mg. Naphthaline Per Cubic Meter.
0	.5	17.6
5	2.5	88.3
10	4.5	158.8
15	8.0	282.3
20	13.5	476.4
25	23.0	811.0
30	37.5	1323.0
35	59.5	2099.5
40	91.2	3218.0
45	135.0	5996.0
50	194 0	6845.0
55	274.0	9905.0
60	408.0	14396.0

An Inspection of the figures will show that if a gas saturated at 100° F. drops to 80° F. about ¾ of the naphthaline will be thrown out and indicates how local drops of even a few degrees in a street main may produce serious consequences.

There has been considerable contention in the journals that the case is not so simple as here stated. It is claimed that water vapor, or ammonia, or acetylene, or benzol act as "carriers" of naphthaline, so that gas under certain conditions, due to the presence of these "carriers," may hold more naphthaline as vapor than it normally should. Theoretically, as we have before stated, the amount of naphthaline should be entirely independent of the nature of the gas and should be dependent only on the temperature. In the case of the simultaneous presence of naphthaline vapors and those of water, for example, where the naphthaline and water are practically insoluble in one another, the amount of naphthaline vapor per cubic foot of gas saturated with moisture should remain the same as it was per cubic foot of dry gas. The presence of vapors of a liquid like benzol in which the naphthaline is soluble complicates the matter and that subject will be treated separately.

Experimental work was first undertaken to determine the effect of water vapor. Instead of drying the gas before passing it over the naphthaline it was passed through a water saturator contained in the same air oven in which the naphthaline tubes were contained so that the gas entered the naphthaline tubes completely saturated with moisture at a known temperature. It is much more difficult, experimentally, to work with wet than with dry gas because of the danger of water condensing in the weighed naphthaline tubes. It is also necessary to make several determinations in succession before the results become constant because the naphthaline saturates itself with water vapor very slowly. The results given below show that, allowing for the increase in volume caused by the water vapor, which behaves just like a corresponding volume of air, the results are in accord with those obtained with dry gas. Naphthaline behaves towards gas containing water vapor precisely as was to be theoretically expected. The following table gives the amount of naphthaline required to saturate a cubic foot of air measured dry under standard conditions, and then allowed to saturate itself with water vapor at the temperature indicated, as compared with the amount which would have been required to saturate it had it remained dry. The percentage increase in volume due to water vapor is also given and in the last column the amount of naphthaline corrected for this increase in volume. The satisfactory agreement between columns 2 and 5 shows that the water vapor has exerted no peculiar influence but has simply acted like so much gas.

Temperature, Deg. C.	Milligrams Naphthaline per Cubic Foot. Dry Air.	Milligrams Naphthaline per Cubic Foot. Air saturated with Moisture.	Increased Vol. of Air due to Water Vapor. Per Cent.	Milligrams Naphthaline per Cubic Foot calculated for Dry Air from Saturated.
27	28	28.8	2.3	28.2
42.5	111	120	6.0	113
59.75	400	474	16.2	408

The effect of ammonia upon the vapor tension was tested by allowing the gas from the gasometer to bubble through strong ammonia water and then passing it through a calcium chloride drying tube and into the oven containing the weighed naphthaline tubes as before. The amount of ammonia thus taken up was not large measured in per cent., but it was far higher than would be found in gas manufacture. The increase in volume should produce slightly higher results. The results show substantial agreement within the limits of experimental error between the results obtained with or without ammonia as shown by the following figures:

Temperature.	Milligrams of Naphthaline per Cubic Foot of Gas.	Milligrams of Naphthaline per Cubic Foot of Gas and Ammonia.
26° C.	25.0	24.1
26°	25.0	24.2
30.5°	40.0	46.7

The possible influence of hydrocarbon gases was studied by comparing air with illuminating gas and with acetylene, to which Birchmore attributes special influence. Some figures are given below.

Temperature.	Milligrams of Naphthaline per Cubic Foot of Air.	Milligrams of Naphthaline per Cubic Foot of Illuminating Gas.	Milligrams of Naphthaline per Cubic Foot of .90 Illuminating Gas, .10 Acetylene.
24.6° C.	22.0	20.7	
32.5°	47.5	48.3	47.8
60°	408.0	405.0	

An experiment with pure acetylene gave just the same result as was to have been expected from pure air.

We have thus been unable to find any abnormality in the vapor tension of naphthaline due to the presence of moisture, ammonia or hydrocarbon gases.

Benzol by virtue of its solvent power for naphthaline behaves somewhat differently from the gases mentioned, and theoretically we should expect to find that benzol diminished the vapor tension of naphthaline.

Our experiments indicate the contrary and seem to show that benzol exerts a specific influence and is able to carry more naphthaline than other vapors. This can be accounted for only on the assumption of a molecular combination between benzol and naphthaline. Since this is such an unexpected phenomenon we prefer to revise our work carefully before making a definite statement. In any case the per cent. of benzol in coal gas is so small that it would not affect the vapor tension of naphthaline in coal gas to any marked extent. The question may be of importance in connection with the use of benzol to remove naphthaline stoppages.

Tests Made in Gas Works.—It was only after all the preceding ground had been covered that it was possible to commence a profitable study of the actual conditions prevailing in gas works, for it was necessary to be able to determine at any point and to make comparisons at various points in the system of the amount of naphthaline present in the gas and dissolved in the suspended tar and to know whether any naphthaline had been removed from the gas, and if so where it had gone to and whether it had been because the gas had been cooled till the naphthaline had been thrown out, or whether there had been some other cause.

During the summer of 1903 samples of tar were collected from various works throughout the State. Some of these works were having trouble with naphthaline at the time. The specific gravity and amount of naphthaline in these tars, together with some data concerning yield, coal used, etc., are given in Table III. The striking fact to be noted in connection with these analyses is that the two works whose well tars are low in naphthaline were the two works which had trouble with naphthaline. Apparently for some unknown reason the naphthaline was not being taken out by the tar in proper amount, but was passing into the street mains. It may also be noted that the tars with highest specific gravity carry the least naphthaline, and that there is an almost steady decrease in specific gravity with increase in naphthaline. This may be because the heavy tars are unable to take up so much naphthaline by virtue of their different chemical composition, or it may be that because of differing local conditions they have not had the same opportunity to take up naphthaline and hence are stiff and heavy. It is a point of practical interest in connection with the utilization of tar and will receive further attention.

The lack of analytical methods and of knowledge as to the behavior of naphthaline towards various gases prevented a more thorough investigation at that time. Indeed it was not until well on in the winter that it was possible to analyze the tars collected the preceding summer. With the opening of spring, however, it was possible to make some tests in the gas works to better advantage. The largest number of tests were made at the Ann Arbor works, and were scattered from March to July.

TABLE IV.—*Tests at Ann Arbor Gas Works.*

Point of Sampling.	Date.	Temperature Degs. F.	Naphthaline in Milligrams per Cubic Feet of Gas.		Total.	Per Cent. Saturation Naphthaline in Gas.	Temperature Before Naphthaline Would Deposit. Degs. F.
			As Va'pr in gas.	In Sus'pd tar.			
Hydraulic main.	4–12 A.M.	...	.5	97.	97.5	....	....
	4–12 P.M.	...	1.5	?	?	....	....
	5–31 P.M.	179	....	....	121.	....	....
	6–1 P.M.	179	..	....	59.	....	....
	7–25 P.M.	172	.0	128.	128.	....	....
	8–1	...	.8	78.6	79.4	....	....
	8–1	...	.9	78.9	79.8	....	....
Foul main*.....	3–25 P.M.	140	....	....	41.	....	....
	3–26 A.M.	116	....	....	48.	....	....
	4–9 A.M.	118	....	....	81.	....	....
	4–7	120	15.	52.	67.	....	....
Inlet of primary condenser ...	7–25 P.M.	136	1.6	129.	130.6	....	....
Outlet of primary condenser	6–6	112	16.	63.	79.	....	....
	6–6	112	15.	67.	82.	....	....
	7–25	110	3.8	136.	139.8	...	....
Inlet of secondary condenser.....	3–25 A.M.	62	....	....	.8	...	....
	3–26 A.M.	62	....	....	.7	....	....
	4–1 A.M.	67	.5	4.0	4.5	3.8	32
	4–2 A.M.	64	.5	4.0	4.5	4.6	32
	5–31 A.M.	80	2.0	Trace.	2.0	7.3	40
	6–1 P.M.	80	1.5	2.0	3.5	5.5	37
	6–6	86	4.0	7.0	11.0	10.3	48
	6–6	86	2.5	5.0	7 5	6.4	42
	7–26	90	1.5	11.3	12.8	3.2	37
Outlet of secondary condenser.....	5–7 P.M.	87	2.5	....	2.5	6.2	42
Tar washer outlet.	5–7 P.M.	87	.5	....	.5	1.2	32
Scrubber washer outlet	4–1 A.M.	72	6.0	....	6.0	34.6	54
	4–1 P.M.	69	1.0	....	1.0	6.8	34
	4–2 A.M.	67	1.5	....	1.5	11.4	37
Purifier outlet ..	4–7	...	1.0	....	1.0	....	34
	4–7	...	2.0	....	2.0	....	40
Meter outlet	4–9	63	1.0	....	1.0	10.0	34

Hydraul'c main tar taken from seal pot 4–12— 4.66 per cent naphthaline.
Tar from tar washer 5–7 12.4 per cent. naphthaline.
The tests after 6–6 are by Mr. D. H. Clary.

* Only one of the three benches of this set was running, so conditions are about the same as usually found in primary condenser.

TABLE III.—*Test of Tars from Various Works, Summer of* 1903.

Name of Works.	Points from which Tar was Taken.	Sp. Gr. Tar.	Per Cent. Naphthaline in Tar.	Gallon Tar per Ton Coal.	Cubic Feet Gas per Pound of Coal.	Weight of Coal Retort.	Kind of Coal.
Battle Creek.....	Well.....	1.239	4.9	12.0	5.1	320	West Virginia.
Kalamazoo.....	Well.....	1.227	4.9	12.5—13.0	5.0	....	Youghiogheny.
Saginaw.....	Well.....	1.207	6.6	13.0—14.0	5 1	325	"
Grand Rapids.....	Well.....	1.231	6.75	15.0—16.0	5.25—5.3	310—320	"
Port Huron.....	Well.....	1.202	6.8	12.0	4.5 —4.7	330	"
Jackson	Well.....	1.201	7.75	12.5—13.0	5.1	350—360	West Virginia. Pittsburg.
Detroit.....	Hydraulic.....	1.254	5.1	13.5—14.0	4.9 —5.0	330	Pittsburg.
	Separator.....	1.094	12.0				
Lansing	Hydraulic.....	....	4.8	....	....	310—320	Youghiogheny.
	Extractor.....	....	7.6				

In April 4 days were spent collecting samples at the Grand Rapids gas works and in May 3 days at Jackson. All three works were using Youghiogheny coal. The arrangement of the hydraulic main is different in three works, in that Ann Arbor uses a tar seal and Jackson a water seal, while Grand Rapids has tar in the hydraulic main but an anti-dip sysiem. None of the works were troubled with naphthaline at the time the tests were made. The results are given in Tables IV., V. and VI., all analyses from samples taken at one point being grouped together.

The date of sampling is also given, so that it is possible to identify the samples taken simultaneously in different parts of the works.

TABLE V.—*Tests at Grand Rapids Gas Works.*

Point of Sampling.	Date.	Temperature Degs. F.	Naphthaline in Milligrams per Cubic Feet of Gas.		Total.	Per Cent. Saturation Naphthaline in Gas.	Temperature before Naphthaline Would Deposit.
			As Va'pr in gas.	In Susp'd tar.			
Hydraulic main.	4–20 A.M.	161	2	66.	68.	....	....
	4–20 P.M.	....	2	49.	51.	....	...
Inlet to exhauster.	4–22 P.M.	100–106	0	1.5	1.5	....	....
Inlet to secondary condenser.	4–19 A.M.	86	29	2.	31.	77.5	81.
	4–19 P.M.	83	4	3.	7.	12.5	49.
	4–20 A.M.	88–94	2	4.5	6.5	4.2	40.
Outlet, fresh water scrubber.....	4–21 A.M.	71	1	0.	1.	6.2	34.
	4–21 P.M.	70	11	0.	11.	70.9	65.
Outlet to purifying boxes.....	4–18 P.M.	....	3	0.	3.	....	45.
	4–19 A.M.	....	7	0.	7.	....	57.
Governor to street main....	4–21 A.M.	....	0	0.	0.	....	0.
	4–21 P.M.	....	0	0.	0.	....	0.

Tar from hydraulic main, 5.35 per cent. naphthaline.
Tar from foul main, 5.1 per cent. naphthaline.
Tar from extractor, 7.9 per cent. naphthaline.

TABLE VI.—*Tests at Jackson Gas Works.*

Point of Sampling.	Date.	Temperature Degs. F.	Naphthaline in Milligrams per Cubic Feet of Gas.		Total.	Per Cent. Saturation Naphthaline in Gas.	Temperature before Naphthaline Would Deposit. Degs. F.
			As Va'pr in gas.	In Susp'd tar.			
Hydraulic main.	5–11 3 P.M.	125	32.	28.	60.0	....	....
	5–12 8 P.M.	125	25.	33.5	58.5	....	....
	5–12 11 A.M.	125	24.	9.0	33.0	....	....
Primary condenser outlet	5–10 2 P.M.	132	44.	4.0	48.0	....	....
	5–11 3 P.M.	135	52.	10.0	62.0	....	....
Secondary condenser inlet.	5–10 11 A.M.	118	10.	2.0	12.0	6.0	63.
	5–10 2 P.M.	120	25.	0.5	25.5	14.0	78.
	5–10 6 P.M.	118	19.	4.0	23.0	11.5	73.
	5–11 11 A.M.	120	33.	2.0	35.0	18.0	83.
	5–11 3 P.M.	121–114	30.	1.0	31.0	18.0	83.
	5–12 8 A.M.	116	35.	1.5	36.5	23.0	84.
	5–12 11 A.M.	120–114	8.	1.0	9.0	5.3	59.
Scrubber outlet..	5–11 8 A.M.	64	....	....	16.0	....	....
	5–11 8 P.M.	65	11.	2.	13.0	97.	64.
Purifiers outlet..	5–10 6 P.M.	....	3.0	0.	3.0	....	44.
	5–11 7 P.M.	....	4.5	0.	4.5	....	50.

Tar from aydraulic main, 4.2 per cent. naphthaline.
Tar from extractor and secondary condenser, 7.95 per cent. naphthaline.

(To be Concluded.)

Acetylene from a Business Standpoint.[1]

By MR. AUGUSTINE DAVIS.

What is the matter with the acetylene industry? Why is it that a business which has so wide a margin of profit is generally profitless? Why is such an excellent illuminant in such poor repute? Why is acetylene considered so dangerous, when every effort is made to render it otherwise? Who is to blame for this unfavorable situation?

Who can change the conditions? The membership of this convention can change all this to a great extent, but to do so must deal frankly and honestly, each member with the other. We must not think one thing and say another.

Let us go directly to the heart of the matter. The writer does not pretend that he is guiltless, that he may "throw the first stone." He does not even wish to "throw stones" at all, but does hope, by laying the conditions bare as we all know them, to inspire this convention with the courage and business sense necessary to correct the evils for which its membership is responsible.

To begin with, we are all rate cutters; and we know it. We use price lists, in many cases, with high figures, not with the expectation of obtaining list prices, but with the hope that we can make larger discounts than our competitors. Whom do we deceive? Nobody but ourselves.

What is the result? We are surely demoralizing a market which would have long since been ruined but for its very vastness. Why do we do it? Largely because, if we cannot make the sale, we are determined that our successful competitor shall have no profit.

Has there been any improvement along this line? Last year's convention had a marked influence for the better. Among the more prominent manufacturers a decided inclination to maintain better prices is manifest; but the occasional lapses to meet especially exasperating cuts have largely neutralized these efforts, because such instances are generally known and cited as justifications by the more guilty. The worst rate cutters are known, although they may think otherwise. This rate cutting is senseless, useless and demoralizing. It can be stopped almost entirely by the membership of this convention, and it must be stopped before the business can attain the dignity and profit to which it is entitled.

We must make untruthful attacks upon reputable generators disreputable. When a competitor has secured an order, it is discreditable to attempt to make the purchaser dissatisfied. To name a lower price under such circumstances is contemptible. We have powerful rivals in the promoters of other illuminants, whose disparagement is sufficiently difficult to overcome, but their efforts are insignificant compared with our own condemnation of each other. What must a prospective purchaser think of acetylene, who has no knowledge other than the extravagant praise and the unrestricted denunciation of the representatives of two rival generators? How vastly better would the impression have been had each contented himself with presenting the merits of his own apparatus and omitted the unfair criticisms of his rival's machine.

We believe it is fair to make honest comparisons and to point out the differences when there is occasion; but, as a rule, purchasers are not well informed and cannot intelligently comprehend these differences; and, in a majority of cases, criticisms awaken suspicion, and lessen, rather than increase, the favorable impressions of acetylene.

Among the other things which discredit acetylene, of which we are all aware, are the overstatements of its illuminating value, the understating of actual cost, the overrating of lighting capacity, and the construction of generators, not at all in accordance with the specifications agreed upon with the National Board of Fire Underwriters. All of these things are actually dishonest, and will bring their own punishment in due time. But this convention can put its stamp of disapproval on all of these unfavorable conditions so emphatically that it will hasten their discontinuance by all manufacturers who have any claims to decent recognition.

One of the most vital necessities to the broad success of the business is the promulgation by the Union Carbide Company of a permanent policy on carbide supply. While this company has shown a friendly spirit to generator makers generally, and has taken no small part in the success of the International Association, it is unfortunately closely associated with a company which is proving a very strong rival to competing generator manufacturers. Under such conditions, it is not unnatural that its acts should frequently be the objects of suspicion, and not unfrequently be unjustly criticised. It is impossible to conceal the fact that the manufacture and sale of apparatus by this company are looked upon with great disfavor by other manufacturers, because, whether it is ever done or not, there are unusual opportunities for the carbide company to favor its associates in many particulars. This feeling is intensified by the fact that every generator sold adds to the permanent sales and profit of the carbide company, while the manufacturer not only receives no future profit from such sale, but is obliged to compete with the carbide company itself in making the sale. Thus, in order to maintain his own business, he is compelled to fight with the company whose business he is constantly upbuilding. This anomalous condition has been brought about so skillfully and gradually that no serious disturbance has yet occurred. But, now that the manufacturers have been so reduced in number, and the business of the carbide company's subsidiary company has so grown in importance that it is idle to expect the present conditions can much longer exist, would it not be

1. Paper read at the International Acetylene Association Convention, St. Louis, Mo.

Benzol by virtue of its solvent power for naphthaline behaves somewhat differently from the gases mentioned, and theoretically we should expect to find that benzol diminished the vapor tension of naphthaline.

Our experiments indicate the contrary and seem to show that benzol exerts a specific influence and is able to carry more naphthaline than other vapors. This can be accounted for only on the assumption of a molecular combination between benzol and naphthaline. Since this is such an unexpected phenomenon we prefer to revise our work carefully before making a definite statement. In any case the per cent. of benzol in coal gas is so small that it would not affect the vapor tension of naphthaline in coal gas to any marked extent. The question may be of importance in connection with the use of benzol to remove naphthaline stoppages.

Tests Made in Gas Works.—It was only after all the preceding ground had been covered that it was possible to commence a profitable study of the actual conditions prevailing in gas works, for it was necessary to be able to determine at any point and to make comparisons at various points in the system of the amount of naphthaline present in the gas and dissolved in the suspended tar and to know whether any naphthaline had been removed from the gas, and if so where it had gone to and whether it had been because the gas had been cooled till the naphthaline had been thrown out, or whether there had been some other cause.

During the summer of 1903 samples of tar were collected from various works throughout the State. Some of these works were having trouble with naphthaline at the time. The specific gravity and amount of naphthaline in these tars, together with some data concerning yield, coal used, etc., are given in Table III. The striking fact to be noted in connection with these analyses is that the two works whose well tars are low in naphthaline were the two works which had trouble with naphthaline. Apparently for some unknown reason the naphthaline was not being taken out by the tar in proper amount, but was passing into the street mains. It may also be noted that the tars with highest specific gravity carry the least naphthaline, and that there is an almost steady decrease in specific gravity with increase in naphthaline. This may be because the heavy tars are unable to take up so much naphthaline by virtue of their different chemical composition, or it may be that because of differing local conditions they have not had the same opportunity to take up naphthaline and hence are stiff and heavy. It is a point of practical interest in connection with the utilization of tar and will receive further attention.

The lack of analytical methods and of knowledge as to the behavior of naphthaline towards various gases prevented a more thorough investigation at that time. Indeed it was not until well on in the winter that it was possible to analyze the tars collected the preceding summer. With the opening of spring, however, it was possible to make some tests in the gas works to better advantage. The largest number of tests were made at the Ann Arbor works, and were scattered from March to July.

TABLE IV.—*Tests at Ann Arbor Gas Works.*

Point of Sampling.	Date.	Temperature Degs. F.	Naphthaline in Milligrams per Cubic Feet of Gas.		Total.	Per Cent. Saturation Naphthaline in Gas.	Temperature Before Naphthaline Would Deposit. Degs. F.
			As Va'pr in gas.	In Sus'pd tar.			
Hydraulic main.	4–12 A.M.	...	.5	97.	97.5	....	....
	4–12 P.M.	...	1.5	?	?	....	....
	5–31 P.M.	179	....	....	121.	....	....
	6–1 P.M.	179	..	....	59.	....	....
	7–25 P.M.	172	.0	128.	128.	....	....
	8–1	...	.8	78.6	79.4	....	....
	8–1	...	.9	78.9	79.8	....	....
Foul main*.....	3–25 P.M.	140	....	....	41.	....	....
	3–26 A.M.	116	....	....	48.	....	....
	4–9 A.M.	118	....	....	81.	....	....
	4–7	120	15.	52.	67.	....	....
Inlet of primary condenser ...	7–25 P.M.	136	1.6	129.	130.6	....	....
Outlet of primary condenser	6–6	112	16.	63.	79.	....	....
	6–6	112	15.	67.	82.	....	....
	7–25	110	3.8	136.	139.8	....	....
Inlet of secondary condenser.....	3–25 A.M.	62	....	....	.8	...	....
	3–26 A.M.	62	....	....	.7	....	....
	4–1 A.M.	67	.5	4.0	4.5	3.8	32
	4–2 A.M.	64	.5	4.0	4.5	4.6	32
	5–31 A.M.	80	2.0	Trace.	2.0	7.3	40
	6–1 P.M.	80	1.5	2.0	3.5	5.5	37
	6–6	86	4.0	7.0	11.0	10.3	48
	6–6	86	2.5	5.0	7 5	6.4	42
	7–26	90	1.5	11.3	12.8	3.2	37
Outlet of secondary condenser.....	5–7 P.M.	87	2.5	....	2.5	6.2	42
Tar washer outlet.	5–7 P.M.	87	.5	....	.5	1.2	32
Scrubber washer outlet	4–1 A.M.	72	6.0	....	6.0	34.6	54
	4–1 P.M.	69	1.0	....	1.0	6.8	34
	4–2 A.M.	67	1.5	....	1.5	11.4	37
Purifier outlet ..	4–7	...	1.0	....	1.0	....	34
	4–7	...	2.0	....	2.0	....	40
Meter outlet	4–9	63	1.0	....	1.0	I0.0	34

Hydraul'c main tar taken from seal pot 4–12— 4.66 per cent naphthaline.
Tar from tar washer 5–7 12.4 per cent. naphthaline.
The tests after 6–6 are by Mr. D. H. Clary.

* Only one of the three benches of this set was running, so conditions are about the same as usually found in primary condenser.

TABLE III.—*Test of Tars from Various Works, Summer of* 1903.

Name of Works.	Points from which Tar was Taken.	Sp. Gr. Tar.	Per Cent. Naphthaline in Tar.	Gallon Tar per Ton Coal.	Cubic Feet Gas per Pound of Coal.	Weight of Coal Retort.	Kind of Coal.
Battle Creek.....	Well.....	1.259	4.9	12.0	5.1	320	West Virginia.
Kalamazoo.....	Well.....	1.227	4.9	12.5—13.0	5.0	....	Youghiogheny.
Saginaw.....	Well.....	1.207	6.6	13.0—14.0	5 1	325	"
Grand Rapids.....	Well.....	1.231	6.75	15.0—16.0	5.25—5.3	310—320	"
Port Huron.....	Well.....	1.202	6.8	12.0	4.5 —4.7	330	"
Jackson	Well.....	1.201	7.75	12.5—13.0	5.1	350—360	West Virginia. Pittsburg.
Detroit.....	Hydraulic.....	1.254	5.1	13.5—14.0	4.9 —5.0	330	Pittsburg.
	Separator.....	1.094	12.0				
Lansing	Hydraulic.....	....	4.8	....	....	310—320	Youghiogheny.
	Extractor.....	....	7.6				

In April 4 days were spent collecting samples at the Grand Rapids gas works and in May 3 days at Jackson. All three works were using Youghiogheny coal. The arrangement of the hydraulic main is different in three works, in that Ann Arbor uses a tar seal and Jackson a water seal, while Grand Rapids has tar in the hydraulic main but an anti-dip sysiem. None of the works were troubled with naphthaline at the time the tests were made. The results are given in Tables IV., V. and VI., all analyses from samples taken at one point being grouped together.

The date of sampling is also given, so that it is possible to identify the samples taken simultaneously in different parts of the works.

TABLE V.—*Tests at Grand Rapids Gas Works.*

Point of Sampling.	Date.	Temperature Degs. F.	Naphthaline in Milligrams per Cub'c Feet of Gas.		Total.	Per Cent. Saturation Naphthaline in Gas.	Temperature before Naphthaline Would Deposit.
			As Va'pr in gas.	In Susp'd tar.			
Hydraulic main.	4–20 A.M.	161	2	66.	68.	....	....
	4–20 P.M.	....	2	49.	51.	....	...
Inlet to exhauster.	4–22 P.M.	100–106	0	1.5	1.5	....	....
Inlet to secondary condenser.	4–19 A.M.	86	29	2.	31.	77.5	81.
	4–19 P.M.	83	4	3.	7.	12.5	49.
	4–20 A.M.	88–94	2	4.5	6.5	4.2	40.
Outlet, fresh water scrubber.....	4–21 A.M.	71	1	0.	1.	6.2	34.
	4–21 P.M.	70	11	0.	11.	70.9	65.
Outlet to purifying boxes.....	4–18 P.M.	....	3	0.	3.	....	45.
	4–19 A.M.	....	7	0.	7.	....	57.
Governor to street main....	4–21 A.M.	....	0	0.	0.	....	0.
	4–21 P.M.	....	0	0.	0.	....	0.

Tar from hydraulic main, 5.35 per cent. naphthaline.
Tar from foul main, 5.1 per cent. naphthaline.
Tar from extractor, 7.9 per cent. naphthaline.

TABLE VI.—*Tests at Jackson Gas Works.*

Point of Sampling.	Date.	Temperature Degs. F.	Naphthaline in Milligrams per Cubic Feet of Gas.		Total.	Per Cent. Saturation Naphthaline in Gas.	Temperature before Naphthaline Would Deposit. Degs. F.
			As Va'pr in gas.	In Susp'd tar.			
Hydraulic main.	5–11 3 P.M.	125	32.	28.	60.0	....	....
	5–12 8 P.M.	125	25.	33.5	58.5	....	....
	5–12 11 A.M.	125	24.	9.0	33.0	....	....
Primary condenser outlet	5–10 2 P.M.	132	44.	4.0	48.0	....	....
	5–11 3 P.M.	135	52.	10.0	62.0	....	....
Secondary condenser inlet. .	5–10 11 A.M.	118	10.	2.0	12.0	6.0	63.
	5–10 2 P.M.	120	25.	0.5	25.5	14.0	78.
	5–10 6 P.M.	118	19.	4.0	23.0	11.5	73.
	5–11 11 A.M.	120	33.	2.0	35.0	18.0	83.
	5–11 3 P.M.	121–114	30.	1.0	31.0	18.0	83.
	5–12 8 A.M.	116	35.	1.5	36.5	23.0	84.
	5–12 11 A.M.	120–114	8.	1.0	9.0	5.3	59.
Scrubber outlet..	5–11 8 A.M.	64	....	....	16.0	....	....
	5–11 8 P.M.	65	11.	2.	13.0	97.	64.
Purifiers outlet..	5–10 6 P.M.	....	3.0	0.	3.0	....	44.
	5–11 7 P.M.	....	4.5	0.	4.5	....	50.

Tar from aydraulic main, 4.2 per cent. naphthaline.
Tar from extractor and secondary condenser, 7.95 per cent. naphthaline.

(To be Concluded.)

Acetylene from a Business Standpoint.[1]

By MR. AUGUSTINE DAVIS.

What is the matter with the acetylene industry? Why is it that a business which has so wide a margin of profit is generally profitless? Why is such an excellent illuminant in such poor repute? Why is acetylene considered so dangerous, when every effort is made to render it otherwise? Who is to blame for this unfavorable situation?

Who can change the conditions? The membership of this convention can change all this to a great extent, but to do so must deal frankly and honestly, each member with the other. We must not think one thing and say another.

Let us go directly to the heart of the matter. The writer does not pretend that he is guiltless, that he may "throw the first stone." He does not even wish to "throw stones" at all, but does hope, by laying the conditions bare as we all know them, to inspire this convention with the courage and business sense necessary to correct the evils for which its membership is responsible.

To begin with, we are all rate cutters; and we know it. We use price lists, in many cases, with high figures, not with the expectation of obtaining list prices, but with the hope that we can make larger discounts than our competitors. Whom do we deceive? Nobody but ourselves.

What is the result? We are surely demoralizing a market which would have long since been ruined but for its very vastness. Why do we do it? Largely because, if we cannot make the sale, we are determined that our successful competitor shall have no profit.

Has there been any improvement along this line? Last year's convention had a marked influence for the better. Among the more prominent manufacturers a decided inclination to maintain better prices is manifest; but the occasional lapses to meet especially exasperating cuts have largely neutralized these efforts, because such instances are generally known and cited as justifications by the more guilty. The worst rate cutters are known, although they may think otherwise. This rate cutting is senseless, useless and demoralizing. It can be stopped almost entirely by the membership of this convention, and it must be stopped before the business can attain the dignity and profit to which it is entitled.

We must make untruthful attacks upon reputable generators disreputable. When a competitor has secured an order, it is discreditable to attempt to make the purchaser dissatisfied. To name a lower price under such circumstances is contemptible. We have powerful rivals in the promoters of other illuminan'ts, whose disparagement is sufficiently difficult to overcome, but their efforts are insignificant compared with our own condemnation of each other. What must a prospective purchaser think of acetylene, who has no knowledge other than the extravagant praise and the unrestricted denunciation of the representatives of two rival generators? How vastly better would the impression have been had each contented himself with presenting the merits of his own apparatus and omitted the unfair criticisms of his rival's machine.

We believe it is fair to make honest comparisons and to point out the differences when there is occasion; but, as a rule, purchasers are not well informed and cannot intelligently comprehend these differences; and, in a majority of cases, criticisms awaken suspicion, and lessen, rather than increase, the favorable impressions of acetylene.

Among the other things which discredit acetylene, of which we are all aware, are the overstatements of its illuminating value, the understating of actual cost, the overrating of lighting capacity, and the construction of generators, not at all in accordance with the specifications agreed upon with the National Board of Fire Underwriters. All of these things are actually dishonest, and will bring their own punishment in due time. But this convention can put its stamp of disapproval on all of these unfavorable conditions so emphatically that it will hasten their discontinuance by all manufacturers who have any claims to decent recognition.

One of the most vital necessities to the broad success of the business is the promulgation by the Union Carbide Company of a permanent policy on carbide supply. While this company has shown a friendly spirit to generator makers generally, and has taken no small part in the success of the International Association, it is unfortunately closely associated with a company which is proving a very strong rival to competing generator manufacturers. Under such conditions, it is not unnatural that its acts should frequently be the objects of suspicion, and not unfrequently be unjustly criticised. It is impossible to conceal the fact that the manufacture and sale of apparatus by this company are looked upon with great disfavor by other manufacturers, because, whether it is ever done or not, there are unusual opportunities for the carbide company to favor its associates in many particulars. This feeling is intensified by the fact that every generator sold adds to the permanent sales and profit of the carbide company, while the manufacturer not only receives no future profit from such sale, but is obliged to compete with the carbide company itself in making the sale. Thus, in order to maintaiu his own business, he is compelled to fight with the company whose business he is constantly upbuilding. This anomalous condition has been brought about so skillfully and gradually that no serious disturbance has yet occurred. But, now that the manufacturers have been so reduced in number, and the business of the carbide company's subsidiary company has so grown in importanee that it is idle to expect the present conditions can much longer exist, would it not be

1. Paper read at the International Acetylene Association Convention, St. Louis, Mo.

wise to change these conditions voluntarily, rather than to have them continued until they become so intolerable that they will be upset by an uncontrollable upheaval.

Another irritaiing feature is the disposition of the carbide company to dictate the manner in which its product shall be used. It is inclined to insist that plans for installing town plants shall be submitted before it will place the applicant on the same basis as its own company, with regard to price. No applicant can help feeling that he is submitting his plans to a business rival. Such conditions can be conducive to nothing but discord.

There is also a strong disposition to refuse to the automatic generator the same terms for carbide as those granted to non-automatic for town lighting. While, for large installations, we believe that a gasholder of at least moderate capacity should be used, there are many of the smaller installations where satisfaction can be given with the automatic generator, where the non-automatic would be prohibitory in cost. We believe that responsible manufacturers should be permitted to make installations of this kind, at least until there are some failures to substantiate such a policy. Electrical plants are established everywhere, although their failure is a very common occurrence.

This article is written for what is believed to be the best interests of the acetylene industry. Burying our heads in the sands of deception in the attempt to blind ourselves to well-known facts, will avail nothing. The sooner we bravely acknowledge the character of the ills from which we suffer, the greater the hope for their ultimate cure.

So far as the writer is concerned, he has always received unfailing courtesy, from not only the managers of the carbide company, but from those of the apparatus company as well. While some business transactions have not been satisfactory, they have been freely discussed in a businesslike manner that commands respect. However, even these methods will not long overcome the widespread dissatisfaction which most certainly exists.

What shall be done? First, let us purge ourselves of the unbusinesslike and damaging practices of which we are all more or less guilty. Then let us present to the carbide company our real grievances, and it is believed that the management is broad enough and fair enough to see that the policy must be changed materially if it is to command the confidence and co-operation of generator manufacturers generally.

Let it evolve some plan whereby the manufacturer or his agent or both may participate, at least to a small extent, in the future business he is helping to create. If it feels that it is necessary to inspect the installation of town lighting systems, in order to grant special rates on carbide, let it formulate general rules to be complied with, and issue them to manufacturers without charge, and in advance, and not compel us to submit our plans to a business rival.

If the carbide company thinks that it must continue a company of its own creation as our most formidable rival, then let it put itself in a position where it cannot be suspected of partiality. Let it discontinue the practice of stating, each time that it grants a special price or condition, that such price or condition may be cancelled or annulled at any moment. So long as these conditions exist the business cannot flourish and prosper.

The membership of this convention have the power to correct the evils which render the business unsetisfactory and unprofitable. It must not be expected that this can be done without spirited discussions and possibly dissensions. Where there is such vital antagonism of interests, there must be yielding and compromise; but every manufacturer must be made te feel that he is to have a fair chance to operate on a permanent business and without dictation.

Every member present must acknowledge the splendid energy and persistence which have been exerted by the Secretary of this Association to secure a large attendance at this meeting, and such able and modest effort by a prominent official of the carbide company is unmistakable evidence that reasonable requests, properly presented, will receive at least respectful consideration by such company.

Among ourselves there must be frankness and fair dealing, and good faith in executing our agreements. Everything considered, our list prices are fair to the consumer, and our discounts afford liberal compensation to the agent. With these prices maintained, and a satisfactory carbide supply, the business would soon be profitable to both the maker and the salesman. Under the present conditions there is constant dissatisfaction.

Unless this organization possesses the courage and determination to change the situation, it may as well disband, because it cannot hope for success under the present deceptive and unbusinesslike conditions.

ITEMS OF INTEREST FROM VARIOUS LOCALITIES.

THE proprietors of, or someone else, in high rank in the offices of the Otto Gas Engine Company, of Philadelphia, have applied to the authorities of Wilmington, Del., through the Street and Power Department of that city, for the right to manufacture and distribute gas in Wilmington.

A CERTIFICATE incorporating the Adirondack Gas Company, of Saranac, N. Y., has been filed with the Secretary of State.

SENOR CORTINO BUSTILLO, acting President of the Gas and Electricity Company, of Havanna, Cuba, announces that the Company has been granted a charter and that hereafter its corporate title is to be as above stated. The capitalization of the Company is $2,000,000.

A CORRESPONDENT in Davenport, Ia., writing under date of September 29th, says: "The Supreme Court of the State has overruled the motion for a new trial in the case of the Davenport Gas and Electric Company vs. the City of Davenport, which was decided in favor of the Gas Company in the District Court. This is the termination of a case which aroused more public interest, probably, than any other local law suit in the legal history of the county. It arose over difficulties regarding the 25-year franchise which the Gas Company has to light the city streets. The City Council refused to recognize the charter, claiming it was not legal. It refused to pey for the lights and the Gas Company started a suit in the District Court. The case was tried before Judge Wolfe, who decided in favor of the Gas Company. It was then taken to the Supreme Court on an appeal by the city, where it was pending for over a year. Upon trial last winter the Supreme Court affirmed the decision of the lower court and the city made a motion for a new trial, with the result as above stated.

THE authorities of Hastings, Mich., are asking for proposals for the establishing of a gas works. They say they will grant liberal terms.

MR. CHARLES W. WISSEL has been appointed Plumbing Inspector for Terre Haute, Ind., vice Mr. John Nugent, who returns to the service of the Citizens Gas and Fuel Company, of Terre Haute.

ACCORDING to recent advices by way of Kansas City, Mo., Mr. Frank D. Moses has applied to the authorities of Kansas City, Kas., for a franchise to lay mains in the streets and alleys to supply natural gas for cooking and lighting. The plan is to pipe natural gas from Southern Kansas. The gas is to be sold at 40 cents per 1,000 cubic feet for lighting and cooking and 25 cents per 1,000 cubic feet for heating. The city is to receive free lights for its public buildings, 2 per cent. of the Company's earnings and street lamps at $4 each. A bond of $50,000 is to be given as a guarantee that work will be begun within 6 months after the granting of the franchise.

A CORRESPONDENT in Leeds, England, writing under date of September 23d, says: "It is not often that a dispute like the recent one at the works here of Messrs. Graham, Morton & Co., involving as it did some hundreds of skilled workmen and their employers, is settled with such promptness, and so thoroughly as was the dispute that a week ago induced the boilermakers employed by the named concern to leave their work in a body. In this particular instance the spirit of firmness on the part of the employers, in maintaining absolute freedom to employ in their works non-unionists equally with unionists, leavened with a blending of conciliation, by which Mr. Maurice Graham was induced to accord an interview to the representatives of the Executive Council of the Boiler Workers' and Shipbuilders' Society are, in large measure, responsible for the happy results. The union officials showed good sense in refusing to recognize the unauthorized action of the men in absenting themselves from work, and on the other hand Messrs. Graham, Morton & Company evinced their sense of fairness by undertaking to take back as many men as they required. Some minor grievances, as to checking and the question of overtime, will now be settled by the firm having joined the Employers' Federation. They refuse to be coerced by the union into employing only union men, and maintain their position; that is, perfect freedom to employ whom they please and no interference in the management of their business."

"C. R. W.," is informed that the gas plant at Athens, Ga., was recently taken over by Messrs. Chas. B. Kelsey and C. F. Young. The capitalization of the Company has been increased in the sum of $100,000, and the new owners say they will put the plant in good order. It is in pretty bad order just now.

MR. GEORGE F. GOODNOW, of the North Shore Gas Company, Ills., has recommended the purchase to certain Chicago capitalists of the rights and properties heretofore vested in the old El Paso (Tex.) Gas Company.

AT the annual meeting of the shareholders in the Amherst (Mass.) Gas Company the officers elected were: Directors, C. F. Deuel, E. D. Marsh, M. A. Dickerman, L. M. Hills, Fred. Tuckerman, George Cutter, Jr., and Henry Adams; President, E. D. Marsh; Secretary and Treasurer, C. F. Deuel.

THE Central Labor Union, of Boston, after settling its labors in annual convention some days ago, such as the election of officers and other less weighty affairs, trained their best guns upon the gas makers of Boston "and vicinity"—it is queer the interest attacked pays the highest rates of wages for value received of any other large employer of labor in that city—as follows:

"*Resolved*, That present methods of the manufacture of gas justify the demand that Boston be supplied with gas at 50 cents per 1,000 cubic feet, and any price more than that is extortion for the purpose of paying dividends on watered stock.

"*Resolved*, That a committee from this body appear before the gas and electric light commissioners and urge a reduction in the price of gas." What do you think of that? Gas in Boston at 50 cents per 1,000! What would the bondholders do then, poor things?

THE Department of Fomento, Mexico, has granted the right to F. P. Moreno, representing the National Iron and Steel Works, to construct and operate a gas works.

THE following is from a recent issue of the Boston *Post:* "It is thought that Mr. C. J. R. Humphreys, as expert valuer of the plants, will file his appraisal of the valuation of the 8 Boston gas companies with the Board of Gas and Electric Light Commissioners in less than a fortnight, after which event the Board will resume hearings on the question of consolidating the several concerns into the Boston Consolidated Gas Company. Financial men are inclined to believe that the Commissioners will fix the capitalization of the new combination at $15,000,000. Expert Howes, who appraised the real estate of the several companies, fixed the valuation of that portion of the assets at $2,782,375, leaving, on a $15,000,000 basis, $12,217,625, as representing the value of the remaining property. A composite balance sheet of the 8 companies, as of June 30, 1904, shows total assets of $22,000,000. After deducting debts of $6,400,000, a balance of $15,600,000 is left. At the present time the names of 100,000 consumers are on the books of the local companies."

THE Directors of the Woonsocket (R. I.) Gas Company have perfected the following organization: President, Edwin Dedrich; Treasurer, R. G. Randall; Superintendent, Z. M. Jenks.

THE Trustees of the village of Glencoe, Ills., have passed an ordinance permitting the North Shore Gas Company to distribute gas for lighting and fuel purposes in that district for the term of 42 years. It is stipulated that the Company may not charge in excess of $1.25 per 1,000 cubic feet.

THE complete list of officers, etc., in the direction of the affairs of the Pacific Coast Gas Association for the ensuing year, is as follows: President, L. P. Lowe, San Francisco; Vice-President, John Martin, San Francisco; Secretary and Treasurer, John A. Britton. Editors: Wrinkles, George S. Colquhoun; Experiences, R. P. Valentine; Novelties, George H. Hollidge. Directors: C. Froelich, San Francisco; Frank A. Cressey, Modesto; W. B. Cline, Los Angeles. Committees: Library, Messrs. E. C. Jones, John. A. Britton and Geo. C. Holberton. Headquarters, John A. Britton, E. C. Jones and John Martin. Membership: Messrs. L. P. Lowe, E. C. Jones and John A. Britton.

A CORRESPONDENT in Clinton, Mass., forwards the following under date of September 29th: "Fred. L. Fullam, of North Brookfield, is to succeed John S. Brown, of Clinton, as Superintendent of the gas division of the Clinton Gas Company's business. Within a few days Mr. Fullam will assume his duties, which will be in connection with some work he is doing for the Boston, Heat, Light and Power Company which controls the Clinton gas and electric plants. W. J. Clarke, an official of the Boston corporation, was in Clinton recently looking over the work which is being done by Mr. Fullam's men at the electric plant of the Company on Parker street. The change comes as a big surprise to Clinton people, for Superintendent Brown is still looking after the interests of the Company in Clinton, and not the least intimation had been given out to the public that he was to sever his connection with the concern. Mr. Fullam is the most widely known contractor of the western section of Worcester county. Some weeks ago he erected a coal shed for the Company on Pleasant street and is now engaged in building a coal slide at the Parker street plant. With the change in management of the gas making plant it is also expected that there will be an enlargement of the distributing end of the Company, for plans are already on foot to lay pipes to Lancaster and distribute the gas by high pressure. The plant is now taxed to its utmost capacity, gas being used to a great extent in Clinton, and forcing the machines to their utmost. The plan of enlargement has been long discussed at the Boston office of the corporation, and within a short time work is expected to start getting things in readiness for increasing the capacity of the plant as well as extending the lines of distribution."

Report of the President of the Pacific Coast Gas Association (Mr. W. A. Aldrich) Respecting His Attendance at the Gas Congress, St. Louis, May, 1904.

SAN FRANCISCO, CAL., July 18, 1904.

To the Members of the Pacific Coast Gas Association: Gentlemen: As one of the representatives of this Association I attended the Congress of Gas Associations of America, held at St. Louis, June 15th and 16th. The proceedings will be published, and it is unnecessary for me to make any extended report. I would say, however, it is a mistake to hold a Congress during a great exposition, as the time devoted to the reading of papers, and subsequent discussions, is necessarily curtailed, owing to the great attractions outside. The papers read were all of general interest to the gas industry, and, with the exception of the paper read by Mr. Henry L. Doherty, comment is unnecessary. This paper (read by Mr. Doherty) was on "Gas Association Work," and discussed the question very thoroughly, the tenor of it being the necessity of concentration of all the Gas Associations of America into one National Association. Following the reading of the paper, over which the speaker had the honor to preside, the following resolutions were proposed and unanimously adopted:

"*Resolved*, That it is the sense of this body that all of the gas men in North America should be united in one Association, with local chapters where conditions make them desirable.

"*Resolved*, That a committee be appointed by the Presidents of this Congress, consisting of two members of each Association and three members representing the gas industry at large, which committee shall draw up a comprehensive plan for a single Gas Association, to be composed of the men engaged in the gas industry in North America; the plan to be submitted to each of the now existing Gas Associations for ratification or amendment, the committee to remain in existence and to continue to represent this Congress until such time as the new Association has been organized and is in working order."

"In order to make this matter complete, I would like further to move that the Secretary of this Congress be authorized and instructed to act as the Secretary for this committee, the compensation of the Secretary to be arranged for."

Upon my return home I received a communication from the Secretary of the Congress requesting action on the above resolutions. Without a doubt the paper read by Mr. Doherty was prompted by the absence of interest at the various Association meetings, and as the annual conventions were held in too close date proximity, in the opinion of the speaker, whatever may be the conditions causing the unsatisfactory attendance when papers affecting the vital interests of the gas world are being read, this is not within the province of this report. Certain it is that I cannot recommend the panacea offered by Mr. Doherty of the National Association.

The territory comprising the scope of the Pacific Coast Gas Association (Montana, Washington, Oregon and California) is so geographically situated, and our proceedings so spontaneous and democratic, where every member, regardless of his official position, be he a new or an old member, is encouraged to give full expression to his ideas, where we have a full attendance at each meeting, where the interest is sustained from the time the President takes the chair to the time his successor is appointed, making our position so unique that I cannot recommend this Association to accept the invitation contained in the set of resolutions presented at the Congress and passed almost without discussion.

The gas appliance exhibit was very creditable and it is to be regretted that more space could not be devoted to it, which the importance of the industry demands. The gas companies and manufacturers of gas appliances lost a grand opportunity of educating the public to the great advantages of gas for street lighting, stores, residences, and for cooking and heating.

In conclusion I have to report that your President has taken no action with reference to the appointment of committees as set forth in the above set of resolutions, as it is a matter which should be decided by this Association.

All of which is respectfully submitted, W. A. ALRICH,
President Pacific Coast Gas Association.

The Market for Gas Securities.

During the week we have witnessed a most peculiar market for city gas shares, the range of pricees having grown smaller as the good buying advanced. Of course, the Newburgh gas man has discounted any chance on earth that he and the other derilect from Nyack ever possessed, so far as gas goes.

The consideration of gas affairs, so far as price goes, is settled, and the ferryman of the Newburgh precincts cuts ice no longer. Consolidated closed to-day (Friday) at 210.

The figures for Brooklyn Union are 222 to 225, and they surely are to go higher. Baltimore gas hangs a bit, but its fair price of 80 to 81 goes, and even Mr. Miller will admit that he thinks well of it, as does his friend whose close connection with the Lincoln National Bank is not so well thought of as it was some months ago. Peoples, of Chicago, seems to be with the trusts. Great are they, if they can maintain prices. The general market is strong.

Advertisers' Index.

GAS ENGINEERS.

	Page
A. E. Boardman, New York City	592
Baxter & Young, Detroit, Mich	592
B. E. Chollar, St. Louis, Mo	578
David Leavitt Hough, New York City	592
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	584
Frank D. Moses, Trenton, N. J	578
Fred. Bredel Co., Milwaukee, Wis	580
Frederic Egner, Washington, D. C	578
Geo. G. Ramsdell, New York City	578 579
Geo. R. Rowland, New York City	584
Humphreys & Glasgow, New York City	608
Isbell-Porter Co., Newark, N. J	594
J. Alex. Mayers, New York City	595
J. F. W. Jost, Philadelphia, Pa	581
Kerr Murray Mfg. Co., Fort Wayne, Ind	592
The Gas Machinery Co., Cleveland, O	580
The Jeffrey Manufacturing Co., Columbus, O	590
The Western Gas Construction Co., Fort Wayne, Ind	560
United Gas Improvement Co., Philadelphia, Pa	587

GAS WORKS APPARATUS AND CONSTRUCTION.

A. E. Boardman, New York City	592
Bartlett, Hayward & Co., Baltimore, Md	593
Baxter & Young, Detroit, Mich	592
Connelly Iron Sponge and Governor Co., New York City	589
Continental Iron Works, Brooklyn, N. Y	594
Cruse-Kemper Co., Philadelphia, Pa	589
Davis and Farnum Mfg. Co., Waltham, Mass	592
Deily & Fowler, Philadelphia, Pa	596
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	584
Frank D. Moses, Trenton, N. J	578
Fred. Bredel Co., Milwaukee, Wis	580
G. Shepard Page's Sons, New York City	592
Humphreys & Glasgow, New York City	592
Isbell-Porter Company, New York City	594
J. Alex. Mayers, New York City	595
Kerr Murray Mfg. Co., Fort Wayne, Ind	592
Lloyd Construction Co., Detroit, Mich	592
Logan Iron Works, Brooklyn, N. Y	593
Quintard Iron Works, New York City	593
R. D. Wood & Co., Philadelphia, Pa	594
Riter-Conley Mfg. Co., Pittsburg, Pa	595
Stacey Mfg. Co., Cincinnati, O	595
The Connersville Blower Company, Connersville, Ind	597
The Gas Machinery Co., Cleveland, O	580
The Jeffrey Manufacturing Co., Columbus, O	590
The Western Gas Construction Co., Fort Wayne, Ind	560
United Gas Improvement Co., Philadelphia, Pa	587

PROCESSES.

Bartlett, Hayward & Co., Baltimore, Md	593
B. E. Chollar, St. Louis, Mo	578
Economical Gas Apparatus Construct'n Co, Toronto, Ont.	584
Fred. Bredel Co., Milwaukee, Wis	580
Humphreys & Glasgow, New York City	593
The Gas Machinery Co., Cleveland, O	580
The Western Gas Construction Co., Fort Wayne, Ind	560
United Gas Improvement Co., Philadelphia, Pa	587

SCRUBBERS AND CONDENSERS.

Continental Iron Works, Brooklyn, N.Y	594
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	584
Fred. Bredel Co., Milwaukee, Wis	580
Isbell-Porter Co., Newark, N. J	594
Kerr Murray Mfg. Co., Fort Wayne, Ind	592
Logan Iron Works, Brooklyn, N. Y	596
R. D. Wood & Co., Philadelphia, Pa	594
Riter-Conley Mfg. Co., Pittsburg, Pa	595
Stacey Mfg. Co., Cincinnati, O	595
The Gas Machinery Co., Cleveland, O	580
The Western Gas Construction Co., Fort Wayne, Ind	560

PRODUCER POWER PLANTS.

Economical Gas Apparatus Construct'n Co., Toronto, Ont.	584
R. D. Wood & Co., Philadelphia, Pa	594

TAR AND CARBONIC ACID EXTRACTOR.

Economical Gas Apparatus Construct'n Co., Toronto, Ont.	584
Fred. Bredel Co., Milwaukee, Wis	580
Isbell-Porter Co., Newark, N. J	594
Stacey Mfg. Co., Cincinnati, O	595
The Gas Machinery Co., Cleveland, O	580
The Western Gas Construction Co., Fort Wayne, Ind	560

AMMONIA CONCENTRATORS.

Fred. Bredel Co., Milwaukee, Wis	580
Michigan Ammonia Works, Detroit, Mich	575
The Gas Machinery Co., Cleveland, O	580
The Western Gas Construction Co., Fort Wayne, Ind	560

GAS METERS.

American Meter Co., New York and Philadelphia	599
Detroit Meter Company, Detroit, Mich	559
D. McDonald & Co., Albany, N. Y	597
Helme & McIlhenny, Philadelphia, Pa	599
John J. Griffin & Co., Philadelphia, Pa	600
Keystone Meter Co., Royersford, Pa	598
Maryland Meter and Mfg. Co., Baltimore, Md	598
Metric Metal Co., Erie, Pa	599
Nathaniel Tufts Meter Co., Boston, Mass	598

PREPAYMENT METERS.

American Meter Co., New York and Philadelphia	599
D. McDonald & Co., Albany, N. Y	597
Helme & McIlhenny, Philadelphia, Pa	599
John J. Griffin & Co., Philadelphia, Pa	600
Keystone Meter Co., Royersford, Pa	598
Nathaniel Tufts Meter Co., Boston, Mass	598

PREPAYMENT METER ATTACHMENTS.

Reeves Mfg. Co., New Haven, Conn	576, 599

GAS AND WATER PIPES.

Central Foundry Co., New York City	584
Charles Millar & Son Co., Utica, N. Y	584
Davis & Farnum Mfg. Co., Waltham, Mass	592
Donaldson Iron Co., Emaus, Pa	84
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	584
M. J. Drummond & Co., New York City	584
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American Hydraulic Motor Co., New York City	583

GAS COALS.

Berwind-White Coal Mining Co., New York and Phila.	590
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Adam Weber Sons, New York City	588
C. W. Hunt Company, New York City	580
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	584
Fred. Bredel Co., Milwaukee, Wis	580
G. A. Bronder, New York City	589
Kerr Murray Mfg. Co., Fort Wayne, Ind	592
The Brown Hoisting Machinery Co., Cleveland, O	591
The Gas Machinery Co., Cleveland, O	580
The Jeffrey Manufacturing Co., Columbus, O	590
The Link-Belt Engineering Co., Philadelphia, Pa	581
The Link-Belt Machinery Co., Chicago, Ills	584
The Western Gas Construction Co., Fort Wayne, Ind	560

CHARGING BARROWS & COAL WAGONS.

Kerr Murray Mfg. Co., Fort Wayne, Ind	592
Stacey Mfg. Co., Cincinnati, O	595

GAS ENRICHERS.

Standard Oil Co., New York City	551
Sun Company, Pittsburg, Pa	591
The Sun Oil Co., Pittsburg, Pa	591

COKE CRUSHERS.

C. M. Keller, Columbus, Ind	591
Fred. Bredel Co., Milwaukee, Wis	580
The Jeffrey Manufacturing Co., Columbus, O	590

STEAM BLOWER FOR BURNING BREEZE.

The Connersville Blower Company, Connersville, Ind	597

ECONOMIZERS.

Green Fuel Economizer Co., Matteawan, N.Y	596

GAS GAUGES.

The Bristol Co., Waterbury, Conn	583

GAS GOVERNORS.

Connelly Iron Sponge and Governor Co., New York City	589
Fred. Bredel Co., Milwaukee, Wis	580
Isbell-Porter Co., Newark, N. J	594
R. D. Wood & Co., Philadelphia, Pa	594

CEMENTS.

C. L. Gerould, Bloomington, Ind	568

RETORTS AND FIREBRICKS.

Adam Weber Sons, New York City	588
Baltimore Retort and Firebrick Co., Baltimore, Md	588
Brooklyn Firebrick Works, Brooklyn, N. Y	588
Harbison-Walker Refractories Co., Pittsburg, Pa	575
Henry Maurer & Son, New York City	588
James Gardner, Jr., Co., Pittsburg, Pa	588
J. H. Gautier & Co., Jersey City, N. J	588
Laclede Firebrick Mfg. Co., St. Louis, Mo	588
Missouri Firebrick Co., St. Louis, Mo	588
Parker-Russell Mining and Mfg. Co., St. Louis, Mo	578
The Kreischer Brick Mfg. Co., New York City	588

INCLINED RETORTS.

Adam Weber Sons (Graham, Morton [England] System)	586
Fred. Bredel Co., Milwaukee, Wis	580
Geo. G. Ramsdell, New York City	578 579
Parker-Russell Mining and Mfg. Co., St. Louis, Mo	578

VERTICAL S'S.

Adam Weber Sons (Oscar B. Weber's Construction)	588
Connelly Iron Sponge & Gov. Co. (Drake's [Eng.] System)	589
Fred. Bredel Co., Milwaukee, Wis	580
Parker-Russell Mining and Mfg. Co., St. Louis, Mo	578

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Bartlett, Hayward & Co., Baltimore, Md	593
Fred. Bredel Co., Milwaukee, Wis	580
J. H. Gautier & Co., Jersey City, N. J	588
Laclede Firebrick Mfg. Co., St. Louis, Mo	588
Missouri Firebrick Co., St. Louis, Mo	588
Parker-Russell Mining and Mfg. Co., St. Louis, Mo	578

SELF-SEALING MOUTHPIECE DOORS.

Continental Iron Works, Brooklyn, N.Y	594
Fred. Bredel Co., Milwaukee, Wis	580
Isbell-Porter Co., Newark, N. J	594
Kerr Murray Mfg. Co., Fort Wayne, Ind	592
Logan Iron Works, Brooklyn, N.Y	596
R. D. Wood & Co., Philadelphia, Pa	594
Stacey Mfg. Co., Cincinnati, O	595
The Gas Machinery Co., Cleveland, O	580
The Western Gas Construction Co., Fort Wayne, Ind	560

CHIMNEY CONSTRUCTION.

Adam Weber Sons, New York City	588

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D. M. Steward Mfg. Co., Chattanooga, Tenn	581
General Gas Light Co., Kalamazoo, Mich	579
Geo. G. Ramsdell, New York City	578 579
Knickerbocker Light and Heat Co., New York City	577
Welsbach Company, Gloucester, N. J	586

BURNERS.

Central Lighting Co., New York City	575
D. M. Steward Mfg. Co., Chattanooga, Tenn	581
Wm. M. Crane Co., New York City	581

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D. M. Steward Mfg. Co., Chattanooga, Tenn	581

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Thos. T. W. Miner, New York City	580
Welsbach Street Lighting Co., New York and Phila	586

GAS FLASH SIGNS.

Qui-Vive Co., Grand Rapids, Mich	561

PURIFIERS.

Connelly Iron Sponge and Governor Co., New York City	589
Fred. Bredel Co., Milwaukee, Wis	580
Isbell-Porter Co., Newark, N. J	594
Kerr Murray Mfg. Co., Fort Wayne, Ind	592
R. D. Wood & Co., Philadelphia, Pa	594
Stacey Mfg. Co., Cincinnati, O	595
The Western Gas Construction Co., Fort Wayne, Ind	560

PURIFYING MATERIALS.

Connelly Iron Sponge and Governor Co., New York City	589

VALVES.

Continental Iron Works, Brooklyn, N. Y	594
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	584
Isbell-Porter Co., Newark, N. J	594
Kerr Murray Mfg. Co., Fort Wayne, Ind	592
Ludlow Valve Manufacturing Co., Troy, N.Y	581
R. D. Wood & Co., Philadelphia, Pa	594
Stacey Mfg. Co., Cincinnati, O	595
The P. H. & F. M. Roots Co., Connersville, Ind	583
The Western Gas Construction Co., Fort Wayne, Ind	560

EXHAUSTERS.

Connelly Iron Sponge and Governor Co., New York City	589
Isbell-Porter Company, Newark, N. J	594
Kerr Murray Mfg. Co., Fort Wayne, Ind	592
The Connersville Blower Company, Connersville, Ind	597
The P. H. & F. M. Roots Co., Connersville, Ind	583

PURIFIER SCREENS.

John Cabot, Hoboken, N. J	580

GRATE BARS.

F. Ferguson & Son, Hoboken, N. J	584

GAS STOVES.

American Meter Co., New York and Philadelphia	599
Detroit Stove Works, Detroit and Chicago	598
Keystone Meter Co., Royersford, Pa	598
Maryland Meter and Manufacturing Co., Baltimore, Md.	598
Nathaniel Tufts Meter Co., Boston, Mass	598

HOT WATER HEATERS.

Humphrey Co., Kalamazoo, Mich	580

GASHOLDER TANKS.

J. P. Whittier, Brooklyn, N.Y	588

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Bartlett, Hayward & Co., Baltimore, Md	593
Continental Iron Works, Brooklyn, N.Y	594
Cruse-Kemper Co., Philadelphia, Pa	583
Davis & Farnum Mfg. Co., Waltham, Mass	592
Deily & Fowler, Philadelphia, Pa	596
Economical Gas Apparatus Construct'n Co., Toronto, Ont.	584
Kerr Murray Mfg. Co., Fort Wayne, Ind	592
Logan Iron Works, Brooklyn, N.Y	596
R. D. Wood & Co., Philadelphia, Pa	594
Riter-Conley Mfg. Co., Pittsburg, Pa	595
Stacey Mfg. Co., Cincinnati, O	595

STORAGE TANKS.

Stacey Mfg. Co., Cincinnati, O	595

PAINTS.
National Paint Works, New York City..... 592
PATENTS, TRADE-MARKS, COPYRIGHTS.
Royal E. Burnham, Washington, D. C..... 580

DIVIDEND NOTICE.

OFFICE OF THE UNITED GAS IMPROVEMENT CO., N. W. CORNER BROAD AND ARCH STS., PHILADELPHIA, PA., Sept. 14, 1904.

The Directors have this day declared a quarterly dividend of 2 per cent. (one dollar per share), payable Oct. 15th, 1904, to stockholders of record at the close of business, Sept. 30, 1904. Checks will be mailed.

1528-4 LEWIS LILLIE, Treasurer.

SUPERINTENDENT WANTED

Eastern town, 7,000 people. Co-operation given by the management to man of determination and reliability. Applicant also to do mechanical work and be able to extend a growing business. Address, stating experience and salary, "C. C. H.,"

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Eastern gas company wants a man of good address who is competent to take charge of a gas property located about 100 miles from headquarters, in a city of over 30,000 population. Salary and an interest in the stock of the company will be given, contingent on results. Address, "X. Y. Z.,"

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A gentleman, familiar with the gas industry, desires a partnership in a manufacturing concern in vicinity of New York, whose product is sold to gas companies. Is prepared to furnish capital. Address,

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GAS COMPANIES, ATTENTION, PLEASE!

DO YOU USE PREPAYMENT METERS?

IF NOT, WHY NOT?

Many gas companies are now using prepayment meters almost exclusively. As they acquired them *gradually*. their experience must have been that they are profitable to use.

Why not profit by the experience of others?

WE KNOW WHY SOME COMPANIES DO NOT USE PREPAYS. It is because in the past they have used defective attachments. **BUT BE FAIR.**

Inventors and manufacturers have spent years of effort and piles of money in perfecting the slot meter. Don't be prejudiced because of former failures, but try the Reeves device as made to-day.

Will this Offer Suit you?

We will send you a consignment of our attachments to put on your own meters. You can use them for any reasonable length of time, and, when satisfied they are all right, pay us for them or return them to us. They can be put on with very little trouble or mutilation of the meter, so this offer is absolutely without risk to you.

We can refer you to numerous gas companies who have been using our device for over two years, and are more than pleased and satisfied with them.

But of course you will want your own experience

SEVERAL METER MANUFACTURERS HAVE ADOPTED OUR ATTACHMENT EXCLUSIVELY.

If *your* meter manufacturer doesn't use them we will supply you direct.

The Reeves attachments are made in our own factory by skilled workmen, and every device guaranteed.

Do you know what are the principal features and improvements in the Reeves attachment?

Long Warning to Consumers.—Light does not go out suddenly and leave consumers in the dark to hunt around for a quarter. The light drops to a small flame, but will not go out for 10 or more hours,

It thus prevents fatal accidents.

The amount of gas used by the *safety* light is insignificant, but is registered just the same and is automatically deducted from the next prepay.

The Reeves device is absolutely accurate, registering by the meter to the foot; you don't have to give a little more or a little less gas for the quarter, as in some devices, but it gives the *exact amount*, no matter what the price per 1,000 feet.

The containing case is of sheet steel—cannot be shattered by a blow, like those of cast iron.

The attachment is small, feeds from the front; therefore occupies very little more room than a plain meter.

The base of attachment is firmly soldered to meter, and, in case of repairs being required to meter, the mechanical portion of attachment can be detached in a few minutes.

The Reeves Mfg. Co. have been makers of clockwork devices (registers, spring motors, etc.) for many years, and our gas meter attachment is the invention of an *expert* who made a study of prepayment attachments and then evolved one that contains every feature desired by gas companies.

Of course, small defects in manufacturing will sometimes occur; but we have had very few returned through defects of any kind.

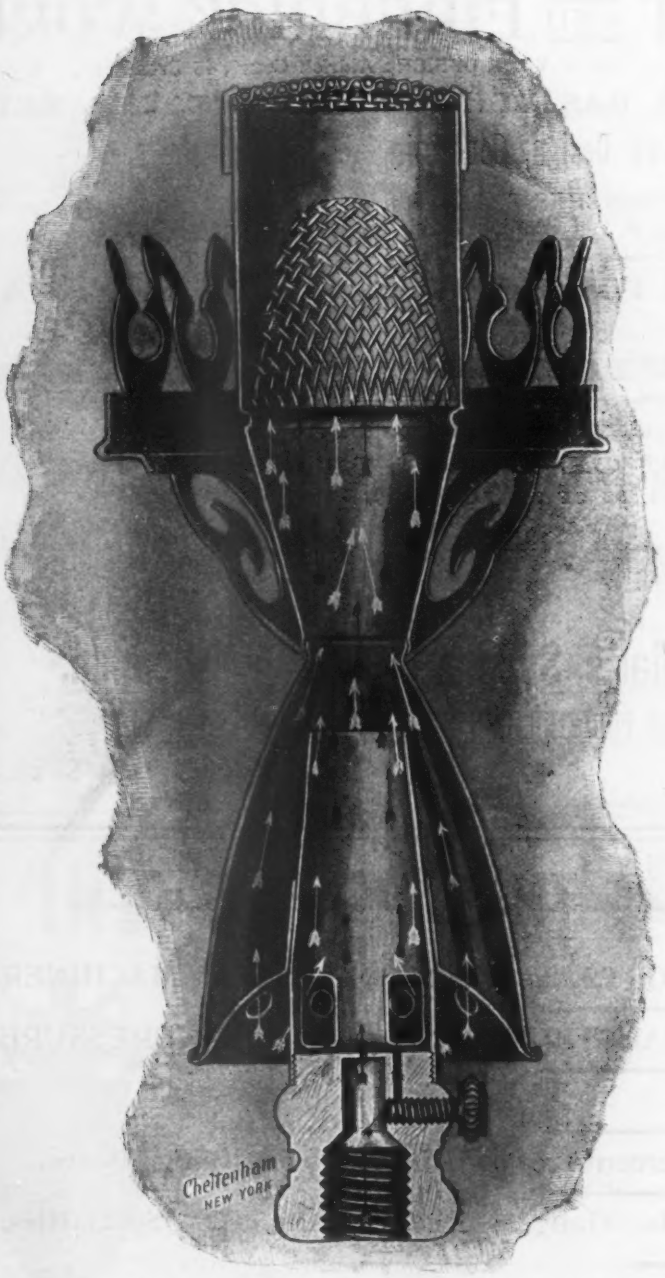
Our first products contained a worm wheel that was not cut deep enough. This we have remedied. We have also perfected an improved valve.

Our device is thoroughly covered by patents, and a new one has just been allowed on the "long warning" valve.

The advantages of prepay meters, when they run perfectly, are known to all gas companies.

If you are not already using the Reeves attachments, *try them at our expense.*

THE REEVES MANUFACTURING CO., New Haven Conn.



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BLACK ARROWS GAS

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TO-DAY

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FOR THE SUGGESTION

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Absolutely Shadowless,
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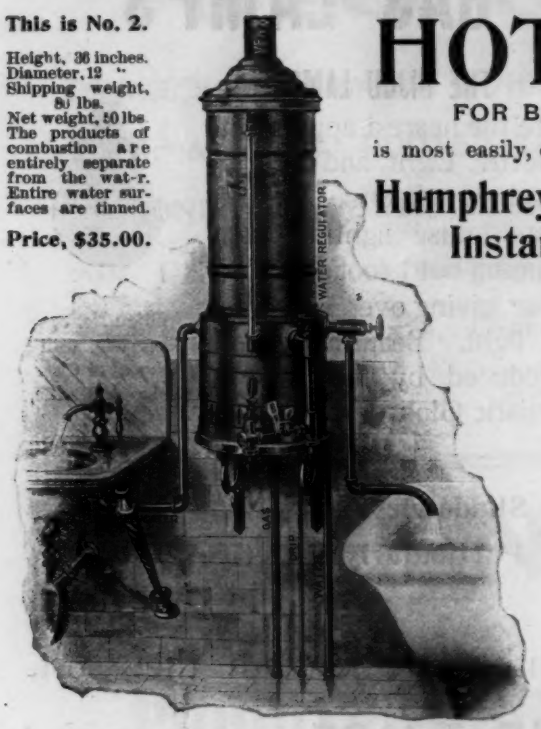

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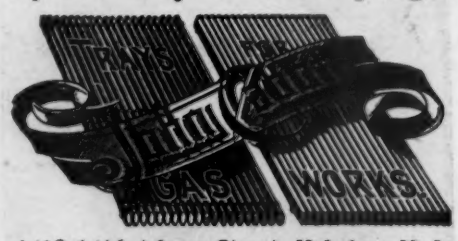

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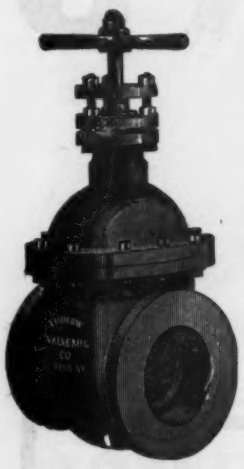
TROY, N. Y., U. S. A.



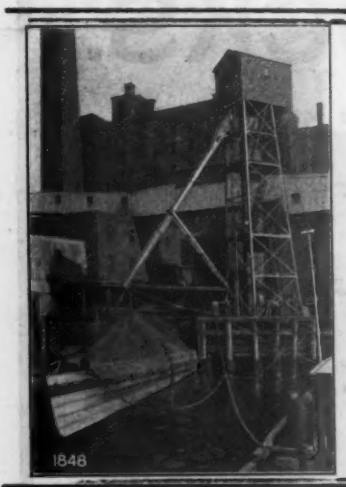
Double and Single Gate Valves, ¼" to 72"

—FOR—

Gas, Water, Steam, Oil, Ammonia, Etc.

HOT GAS VALVES A SPECIALTY.

Send for Catalogue.



Steel-Encased Ashes Elevator,

Installed for Havemeyer & Elder Sugar Refinery, Brooklyn, N. Y. The chute to boat is pivoted and telescopic.

Link-Belt Coal-Handling methods have a place in every manufacturing and power plant. They reduce operating expenses to the minimum, besides saving time and doing the work more efficiently.

LINK-BELT ENGINEERING COMPANY, Philadelphia.

NEW YORK: 49 Dey Street. PITTSBURG: Park Building. CHICAGO: Link-Belt Machinery Co.

THERE'S MORE BUSINESS
In store for Gas Companies who furnish
GAS FLASH SIGNS.
THE QUI-VIVE CO.,
153 Canal St., Grand Rapids, Mich.

FIELD'S ANALYSIS FOR THE YEAR 1903.

An Analysis of the Principal Gas Undertakings in England, Scotland and Ireland. Being the 35th year of publication. Compiled and arranged by JOHN W. FIELD, Sec'y and Gen. Mgr. of The Gas Light and Coke Company, London. Price, $5. For Sale by

A. M. CALLENDER & CO., 42 Pine St., New York City.

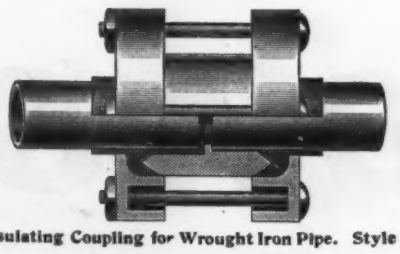
J. F. W. JOST,

CHEMICAL ENGINEER
—IN—
GAS MANUFACTURE,
P. O. BOX 2043, PHILADELPHIA, PA.

S. R. DRESSER,

BRADFORD, PENNSYLVANIA, U. S. A.,

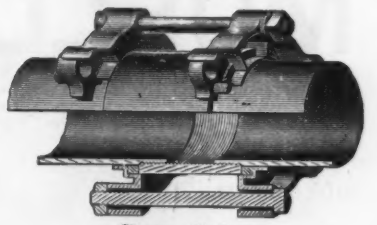
Patentee and Manufacturer of Specialties for Oil and Gas Lines.



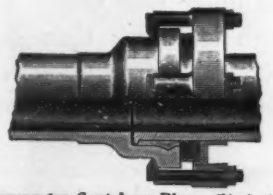
Insulating Coupling for Wrought Iron Pipe. Style 3.

Insulating Coupling for Dresser Bell and Spigot Cast Iron Pipe. Style 6.

Regular Sleeve. Style 2.



Clamp. Style 4.



Clamps for Cast Iron Pipe. Style 4½.

Pipe Couplings, Sleeves, Clamps, Crosses, Tees and Ells.

My Insulating Coupling prevents the destruction of pipe by electrolytic action, in either water or gas lines.

SEND FOR CATALOGUE.

WHAT PRESSURE DO YOU CARRY AT THE BURNERS?

Let us know this and we will send you samples of the right burner for your pressure. We make Steward Burners checked for 8-10, 12-10, 15-10, 20-10, 25-10 or 30-10, and in sizes from 2-foot to 8-foot.

D. M. STEWARD MFG. CO., Est. 1876, CHATTANOOGA, TENN., U. S. A.

LLOYD CONSTRUCTION COMPANY,
DETROIT, MICH.

GAS WORKS BUILDERS.

MUELLER GAS COCKS.

No part of a gas cock gets such hard use as the pipe ends get when the cock is being fitted into service.

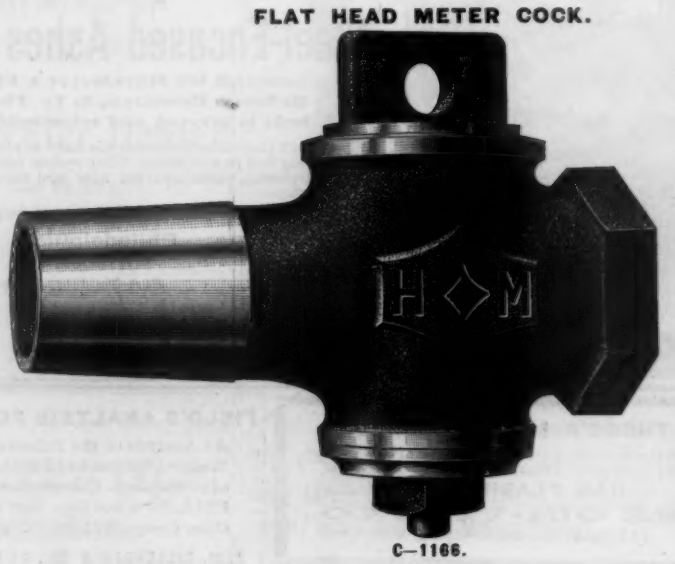
Mueller Gas Cocks are well prepared for the rough handling they get at the hands of the fitter. The pipe ends have more metal and greater strength than any other part of the cock.

Mueller Gas Cocks are made in three grades—standard, extra and special—and in straight, oval and round way opening. The cock illustrated is a special grade, straight way meter cock.

Each cock is carefully inspected and assembled, is given a test as near like actual service use as possible, bears the Mueller trade mark, and is *unconditionally guaranteed.*

We also make meter connections and tapping machines for gas works' use. Catalogues upon application.

FLAT HEAD METER COCK.

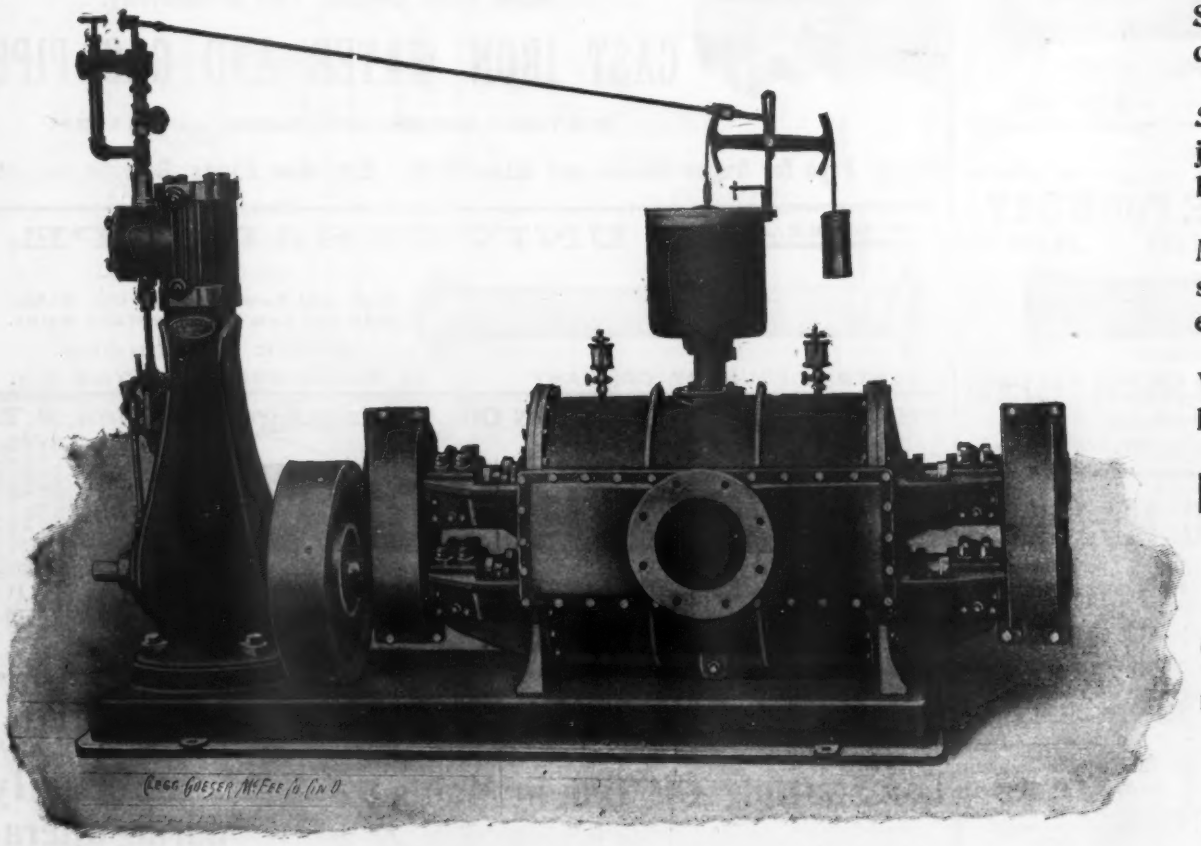


C—1166.

Mueller Gas Cocks are on exhibit in the Palace of Manufactures, World's Fair.

H. MUELLER MFG. CO., - DECATUR, ILL., U. S. A.

ROOTS' GAS EXHAUSTERS.



Sizes for any required capacity.

Self-oiling, adjustable bronze bearings.

Most perfect and sensitive Governor.

Write for Catalogue.

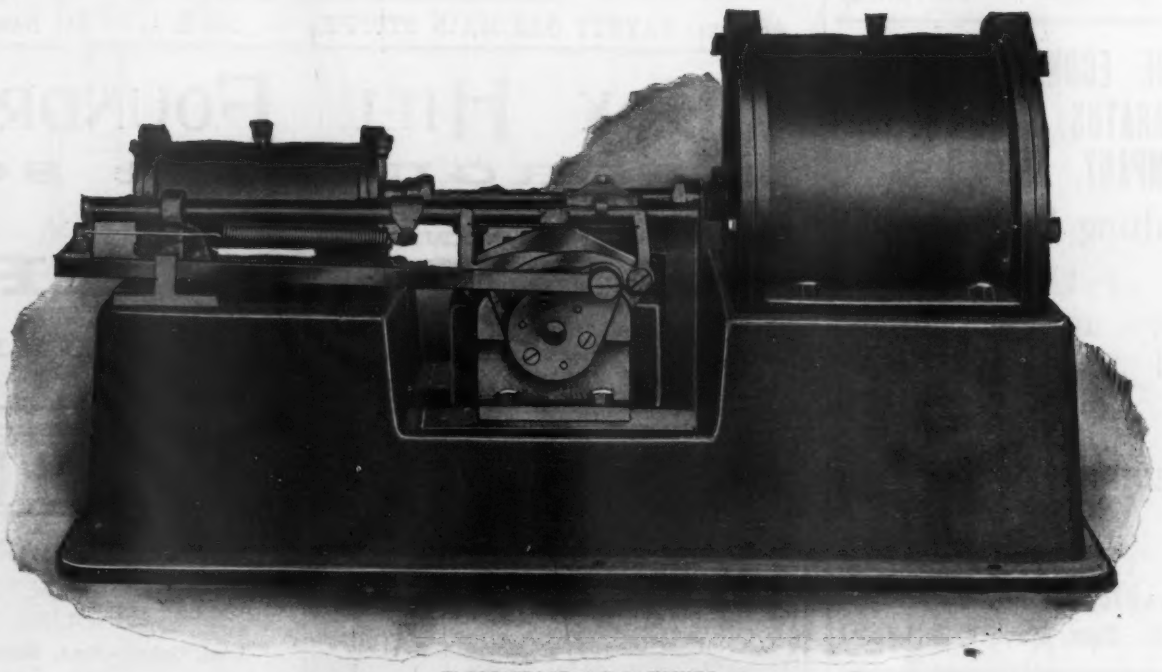
P. H. & F. M. ROOTS COMPANY,

HOME OFFICE:
Connersville, Ind.

NEW YORK OFFICE:
120-122 Liberty St.

CHICAGO OFFICE:
1547 Marquette Bldg.

COMPTON GAS PRESSURE BOOSTER.



FLOOR SPACE, 9 X 23 INCHES.

An automatic gas booster that increases the lighting power of mantle burners over 500 per cent. Obviates the necessity and expense of high pressure gas mains. Booklet, telling all about it, for the asking, mailed free.

AMERICAN HYDRAULIC MOTOR COMPANY,

116 NASSAU STREET, NEW YORK.

M. J. DRUMMOND & CO.
MANUFACTURERS OF
CAST IRON
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GAS and WATER PIPE

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EMAUS PIPE FOUNDRY.
DONALDSON IRON COMPANY. EMAUS, PA.

MANUFACTURERS OF
CAST IRON PIPE AND SPECIAL CASTINGS
FOR WATER AND GAS.
Also, FLANGE PIPE, LAMP POSTS, Etc.

GAS TAPPING MACHINES
—FOR—
Drilling and Tapping Pipe under Pressure
WITHOUT ANY ESCAPE OF GAS.
They are Strong and Compact.
Size of Combination Drills and Taps ¾ to 4-inch.
Machines Sent to any Gas Company for Thirty Days' Trial.
Send for Circulars.
Geo. Light,
DAYTON, O.

THE ECONOMICAL
GAS APPARATUS CONSTRUCTION COMPANY, LIMITED,
Consulting Engineers.
Builders of UP-TO-DATE Machinery and Appliances for Coal and Water Gas Plants. :: :: :: :: ::
PLANS,
SPECIFICATIONS
AND ESTIMATES
PREPARED.
AMERICAN OFFICE:
269 Front St., East, Toronto, Canada.

GEORGE R. ROWLAND,
Formerly with the Continental Iron Works.
Draughtsman and Constructing Engineer.
Drawings, Specifications and Estimates furnished for the construction of new works or alteration of old works. Special attention given to Patent Office drawings.
Office, No. 245 Broadway, N. Y. City.

WARREN FOUNDRY AND MACHINE CO.,
Established 1856. Works at Phillipsburgh, N. J.
New York Office, 160 Broadway.
CAST IRON WATER AND GAS PIPE
FROM THREE TO FORTY-EIGHT INCHES DIAMETER. ALSO, ALL SIZES OF
Flange Pipe for Sugar House and Mine Work. Branches, Bends, Retorts, etc., etc.

NO LEAKY JOINTS IN UNIVERSAL PIPE.
Specially adaptable for—
High and Low Pressure Gas Mains.
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WRITE FOR PRICES.
CENTRAL FOUNDRY COMPANY - - - 116 Nassau Street, New York City.

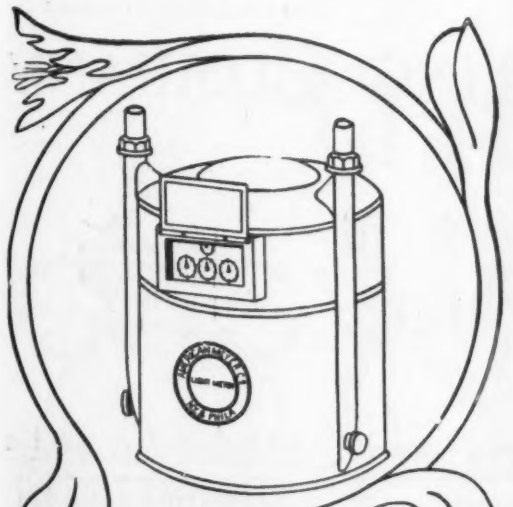
CHARLES MILLAR & SON CO., Selling Agents, Utica, N.Y.
Flanged Pipe and Fittings, Hydrants, Gates, Pig Lead, Jute, etc.
UTICA PIPE FOUNDRY CO.
Manufacturers of Lead Pipe, Solder, etc., and Jobbers of Plumbers' and Tinners' Goods.
CAST IRON PIPE and SPECIALS FOR WATER AND GAS
Wholesale Eastern Agents AKRON VITRIFIED SEWER PIPE.

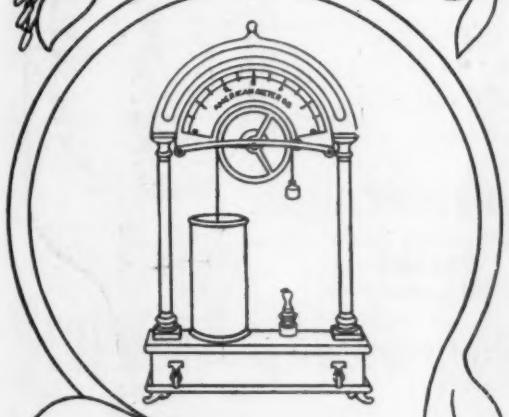
SAFETY GAS MAIN STOPPER COMPANY,
For Shutting Off Gas in Mains
Temporarily during alterations and repairs. : : : :
Any size gas main can be shut off in 30 seconds. : : :
GOODMAN STOPPER
STOPPERS SENT ON TRIAL.
Address: SAFETY GAS MAIN STOPPER CO., 108 E. 117th St., New York City.

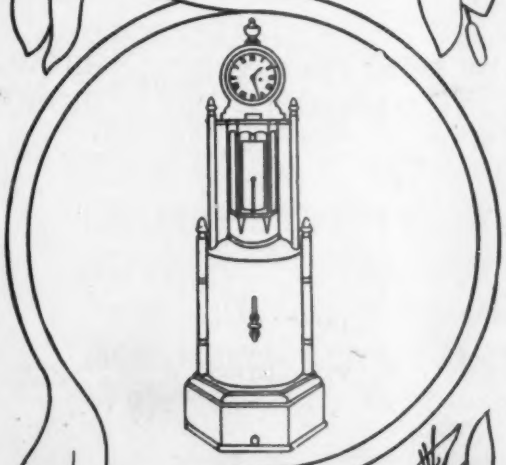
FOX HILL FOUNDRY,
F. FERGUSON & SON,
HOBOKEN, N. J.
FINE OPENING
GRATE BARS
FOR GAS WORKS.
STATIONARY, SHAKING, DUMPING.
BARS FOR HAZELTON BOILERS.

LINK-BELT OPEN TOP CARRIER
HANDLING GAS HOUSE COKE
LINK-BELT
OPEN TOP CARRIER.
ESPECIALLY ADAPTED FOR HANDLING
Coal, Coke, Ashes, Stone, Ores,
Or any heavy or gritty materials, where strength and durability are essential. Constructed in any length or capacity, and to suit local conditions.
WRITE FOR CATALOG
The Link-Belt Machinery Co.
Link-Belt Engineering Co. Philadelphia
Chicago, U.S.A.

(Copyrighted, 1894, by the AMERICAN METER CO.)







AMERICAN METER CO.

ESTABLISHED 1834. INCORPORATED 1868.

NEW YORK,
PHILADELPHIA,
CHICAGO,
ST. LOUIS,
SAN FRANCISCO.

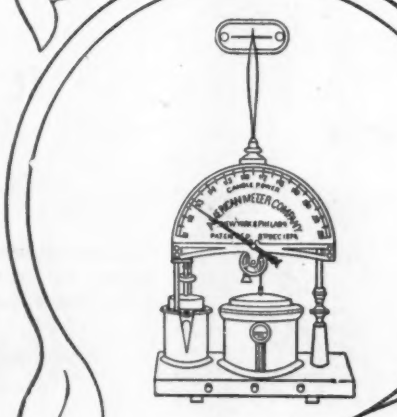
PUBLIC LIGHTING TABLE.

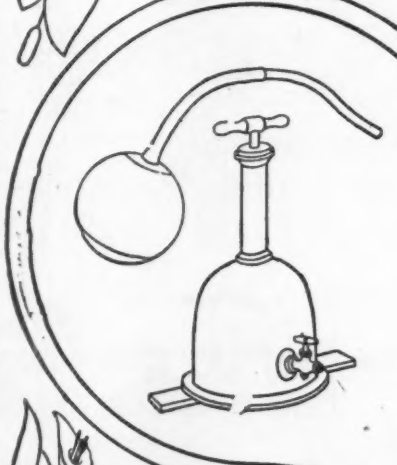
OCTOBER, 1904.

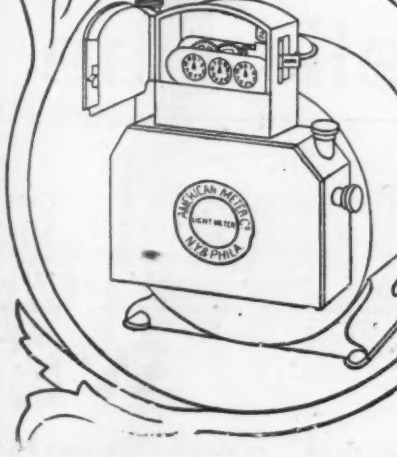
Day of Week.	Date.	Table No. 1. Following the Moon. Light.	Extinguish.	Table No. 2. New York City. All Night Lighting. Light.	Extinguish.
				P.M.	A.M.
Sat.	1	6.20 PM	11.30 PM	5.30	5.00
Sun.	2	6.10 LQ	12.20 AM	5.30	5.00
Mon.	3	6.10	1.30	5.30	5.00
Tue.	4	6.10	2.30	5.30	5.00
Wed.	5	6.10	5.00	5.30	5.00
Thu.	6	6.10	5.00	5.30	5.00
Fri.	7	6.10	5.00	5.30	5.00
Sat.	8	6.10 NM	5.00	5.20	5.10
Sun.	9	6.00	5.10	5.20	5.10
Mon.	10	6.00	5.10	5.20	5.10
Tue.	11	6.00	5.10	5.20	5.10
Wed.	12	6.00	5.10	5.20	5.10
Thu.	13	8.00	5.10	5.20	5.10
Fri.	14	9.00	5.10	5.20	5.10
Sat.	15	9.50 FQ	5.10	5.10	5.20
Sun	16	10.50	5.10	5.10	5.20
Mon.	17	11.40	5.10	5.10	5.20
Tue.	18	12.40 AM	5.10	5.10	5.20
Wed.	19	1.30	5.10	5.10	5.20
Thu.	20	2.30	5.10	5.10	5.20
Fri.	21	3.20	5.10	5.10	5.20
Sat.	22	No L.	No L.	5.00	5.30
Sun.	23	No L. FM	No L.	5.00	5.30
Mon.	24	No L.	No L.	5.00	5.30
Tue.	25	5.40 PM	7.10 PM	5.00	5.30
Wed.	26	5.40	7.50	5.00	5.30
Thu.	27	5.40	8.30	5.00	5.30
Fri.	28	5.40	9.20	5.00	5.30
Sat.	29	5.40	10.20	4.45	5.35
Sun.	30	5.30	11.10	4.45	5.35
Mon.	31	5.30 LQ	12.20 AM	4.45	5.35

TOTAL HOURS LIGHTING DURING 1904.

By Table No. 1.	Hrs. Min.	By Table No. 2.	Hrs. Min.
January	225.00	January	423.20
February	205.40	February	367.40
March	187.40	March	355.35
April	169.50	April	298.50
May	152.30	May	264.50
June	137.20	June	234.25
July	138.50	July	243.45
August	151.00	August	280.25
September	164.40	September	321.15
October	191.30	October	374.30
November	210.30	November	401.40
December	237.10	December	433.45
Total, yr.	2171.40	Total, yr.	4000.00



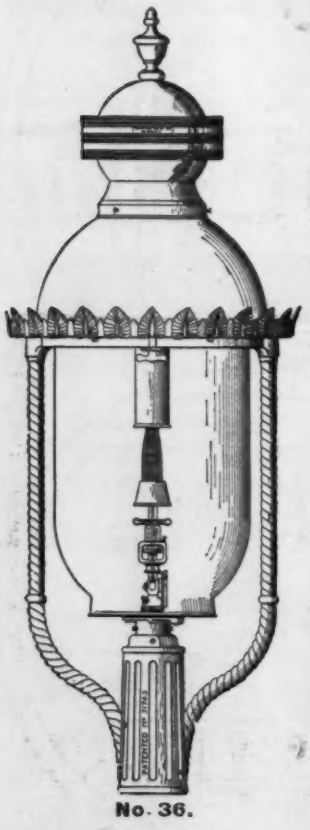




NEW YORK, 97 Liberty Street. BOSTON. 814 Beacon Building. PHILADELPHIA, Broad and Arch Streets. ST. LOUIS, 712 Roe Building. CHICAGO, Foot of Orleans Street. SAN FRANCISCO, 712 Polk Street.

WELSBACH STREET LIGHTING COMPANY

.... OF AMERICA ....



No. 36.

Controls and Operates the

Welsbach System of Street Lighting,

Which includes its specially DESIGNED AND PATENTED BURNER for STREET and PARK LIGHTING exclusively.

Uniformly SUCCESSFUL in 150 Cities and Towns.

By means of the Welsbach System of street lighting the superiority of GAS over electricity for street lighting has been fully demonstrated.

POINTS OF MERIT:

It is { Economical, Attractive, Successful, Up-to-date.

IT LIGHTS THE STREET.

Where there are no gas mains we can furnish an equally good light by our SELF-GENERATING NAPHTHA WELSBACH BURNER, and thereby supply a uniform light in all localities.

Correspondence Solicited from Gas Companies and Others interested in Municipal and Outside Lighting.

No. 38.

AN underlying principle in business is to show an increase each year---to grow. The astute dealer not only seeks to retain this year's customers, but to attract new trade next year.

The formula is simple-

THIS SHIELD IS THE WELSBACH TRADE MARK.

IT IS A GUARANTEE AND A PROTECTION.

Sell The Welsbach Brands.

The imitation stuff is bad for the customer---which is bad for you.

The genuine Welsbachs---Burners or Mantles---make satisfied customers---keep customers---MAKE NEW ONES.

And your profit isn't merely dollars and cents.

WELSBACH CO.,

Broad and Arch Sts., PHILADELPHIA.

THE UNITED GAS IMPROVEMENT COMPANY

For the Period Ending July 31st, 1904, has been Awarded Contracts in the Following Places for

Standard Double-Superheater Lowe Water Gas Apparatus.

Augusta, Me.
Bangor, Pa.
Woonsocket, R. I. (2d contract).
Brooklyn, N. Y. (4th contract).
Cincinnati, O. (2d contract).
Scranton, Pa. (3d contract).
New York City (14th contract).
New Haven Conn. (2d contract).
Watertown, N. Y.
Tampa, Fla. (3d contract).
Westchester, N. Y. (3d contract).
Bridgeport, Conn. (2d contract).
St. Paul, Minn. (2d contract).
Harrisburg, Pa.
Pelham, N. Y.
Reading, Pa.
Springfield, Mass. (2d contract).
Lynn, Mass. (5th contract).

TOTAL SETS, 1904, ... 35
TOTAL DAILY CAPACITY, 1904, . . 50,400,000 cubic feet.
TOTAL SETS TO DATE, ... 543
TOTAL DAILY CAPACITY, . . . 413,180,000 cubic feet.

The United Gas Improvement Company,

Broad and Arch Streets, Philadelphia.

Established 1858. Incorporated 1890.
CHAS. E. GREGORY, Prest. DAVID R. DALY, V.-Prest. & Treas.
H. D. ABERNETHY, Sec.

J. H. Gautier & Co.

Greene & Essex Streets,
Jersey City, N. J.

MANUFACTURERS OF

CLAY GAS RETORTS, FIRE CLAY TILES,
FIRE BRICK and FIRE CLAY SPECIALTIES.

Ground Fire Clay, Fire Sand and Ground Fire Brick in Barrels and Bulk.

SOLE MANUFACTURERS OF THE

FLEMMING GENERATOR GAS FURNACE

Brooklyn Fire Brick Works,

OFFICE AND WORKS:
88 VAN DYKE ST., BROOKLYN, N. Y.
MANUFACTURERS OF

CLAY GAS RETORTS & SETTINGS, GENERATOR LININGS. SPECIALTIES.

Established 1854. Incorporated 1869.

LACLEDE
Fire Brick Manufg. Co.,

Manufacturers of { CAS RETORTS . .
FIRE BRICK . . .
RETORT SETTINGS

Water Gas Cupola Linings, Fire Clay, Etc.

Proprietors for the U. S., Coze System of Inclined Benches.

Estimates Furnished on Application for Most Successful Style of Construction.

Also for Free-Firing and Full and Half-Depth Regenerative Benches, for Burning either Coal or Coke in the Furnaces.

Office:
Cor. Manchester and Sulphur Avenues, St. Louis, Mo.

Established 1845. Reorganized 1902.

The Kreischer Brick Mfg. Co.,

Manufacturers of the very best quality of Clay Retorts, Blocks, Tiles, Settings and Firebrick of every description.

Also Miners and Shippers of Fireclay, Fire Sand, Ground Brick in Barrels.

WORKS: KREISCHERVILLE, STATEN ISLAND.
OFFICE: 119 E. 23D STREET, NEW YORK CITY.

Adam Weber Sons.

GENERAL OFFICES: Park Row Bldg., N. Y. City.
DEPOT & WAREHOUSES: 639 E. 15th St., N. Y. City.
WORKS: Weber, N. J.

ERECTION OF

Modern Coal Gas Plants,

With either Horizontal, Inclined or Vertical Retorts.

PATENTS APPLIED FOR.

No. 1. Firing horizontal benches with pulverized fuel, with either 8 or 10 retorts in 1 setting, using one furnace for two benches. Great saving in labor, fuel and life of retorts and settings. No elaboration of complex recuperation.

No. 2. Independent retort settings, taking all weight from retorts.

No. 3. Vertical retorts with vertical charge and discharge. Sixteen retorts in one bench.

MODERN BENCH IRONWORK.

ISAAC C. BAXTER, President.
Works.
LOCKPORT STATION, PA.

ESTABLISHED 1864.

JAMES GARDNER, JR., CO.,

Successor to WILLIAM GARDNER & SON.

PETER YOUNG, Sec'y and Treas.
Address all communications to
JAMES GARDNER, JR., CO., Room 202 Lewis B'l'dg.
PITTSBURGH, PA.

Fire Clay Goods for Gas Works.

HENRY MAURER & SON,

(ESTABLISHED 1850.)

EXCELSIOR FIRE BRICK & CLAY

RETORT WORKS

WORKS, Perth Amboy, N. J.
OFFICE, 418 to 422 East 23d St., N. Y.

Clay Gas Retorts,

BENCH SETTINGS,

Fire Brick, Tiles, Etc.

GEROULD'S IMPROVED RETORT CEMENT

A Cement of great value for patching retorts, putting on mouthpieces, making up all bench-work joints, lining blast furnaces and cupolas. This cement is mixed ready for use, economic and thorough in its work. Fully warranted to stick.

Price List, f.o.b. BLOOMINGTON, INDIANA.
In Casks, 400 to 800 pounds, at 5 cents per pound.
In Kegs, 100 to 200 " " 6 " "
In Kegs less than 100 " " 7 " "

C. L. GEROULD, BLOOMINGTON, IND.

For orders East of Buffalo, N. Y., or Pittsburg, Pa., freight will be paid to these points.

Bristol's Recording
PRESSURE GAUGE.

For continuous records of
Street Gas Pressure.
Simple in construction, accurate in operation and low in price.

Fully Guaranteed. Send for Circulars.

THE BRISTOL CO.,
Waterbury, Conn.

Silver Medal, Paris Exposition

GASHOLDER TANKS AND GAS WORKS MASONRY COMPLETE.

Plans prepared and Estimates furnished at short notice.

J. P. WHITTIER,
238 Java Street, Brooklyn, N. Y.

THEO. J. SMITH, Prest. J. A. TAYLOR, Sec.
A. LAMBLA, Vice-Prest. and Supt.

BALTIMORE
RETORT & FIRE BRICK CO.

MANUFACTORY AT
LOCUST POINT, BALTIMORE, MD.

Clay Retorts, Blocks & Tiles

FIRE BRICK, FIRE CLAY, AND FIRE CEMENT.

Our Improved Half and Full Depth Benches have been Adopted by Many Gas Companies.

WALDO BROS., 102 MILK ST., BOSTON, MASS.

Sole Agents for New England States.

JOHN DELL,
President and General Manager.

MISSOURI FIRE BRICK CO.,

ESTABLISHED 1882.

MANUFACTURERS OF

Gas Retorts, Bench Settings, Fire Brick, Cupola Linings, Etc.

We are the **Exclusive Agents** *for the* **Mitchell Patent Benches,** *Constructed with Half or Full Depth Furnaces, to Burn either Coal or Coke, and Arranged for Front or* **Rear Clinkering.** *The* **Mitchell** *is the* **Original Coal Firing Bench.** *We also Erect Plain Benches with* **One** *to* **Six Retorts.**

YOUR CORRESPONDENCE IS RESPECTFULLY SOLICITED.

City Office:
411 Olive Street,
Continental Bank,
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Bronder Patent Stoking Machinery.

Three-Scoop and Three-Rake Charging and Discharging Machines are operating in New York, Newark, N. J., Philadelphia, Worcester, Mass., Mt. Vernon, N. Y., Toronto and Montreal, Canada.

Four-Scoop and Four-Rake Charging and Discharging Machines are operating in Detroit, Mich.

These are the only machines that will draw or charge simultaneously 3 or 4 retorts (vertically) and handle from 42 to 60 retorts in from 25 to 30 minutes, lid opening and closing and filling of furnaces included.

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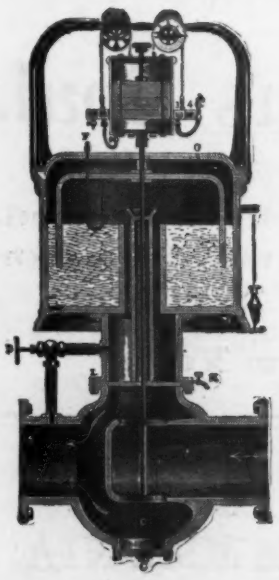

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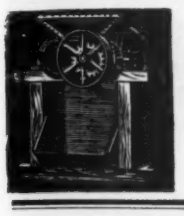

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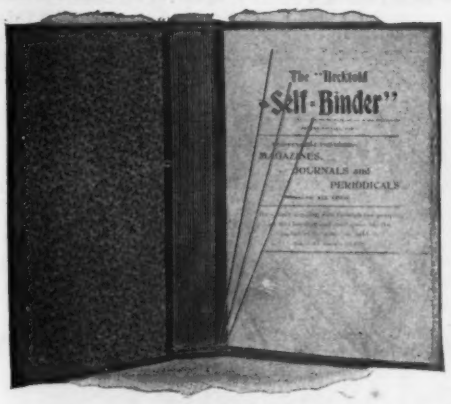

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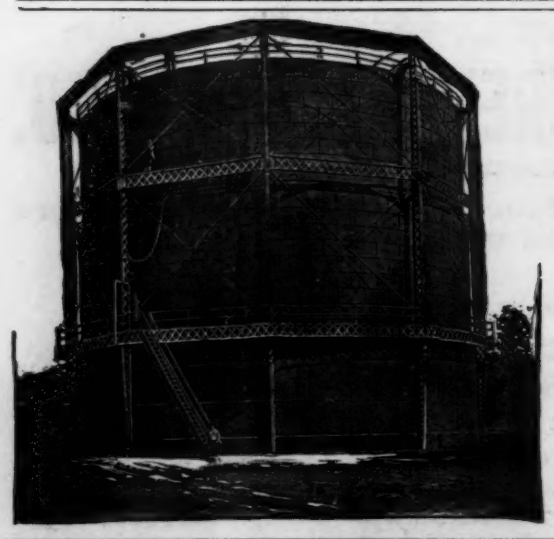

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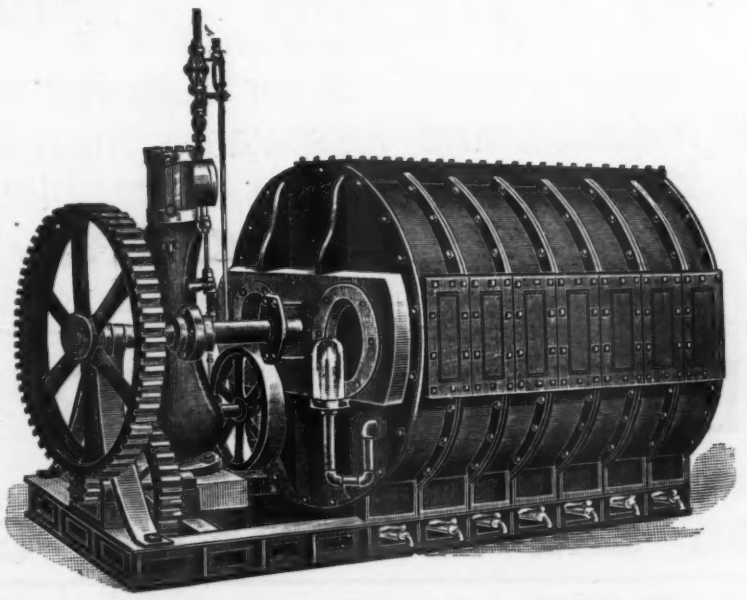

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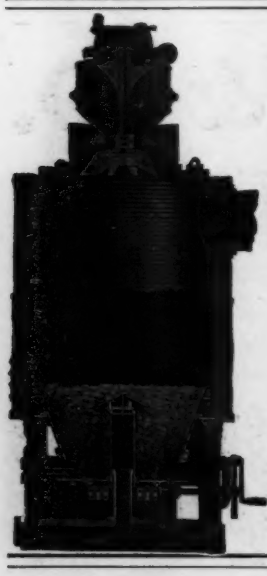

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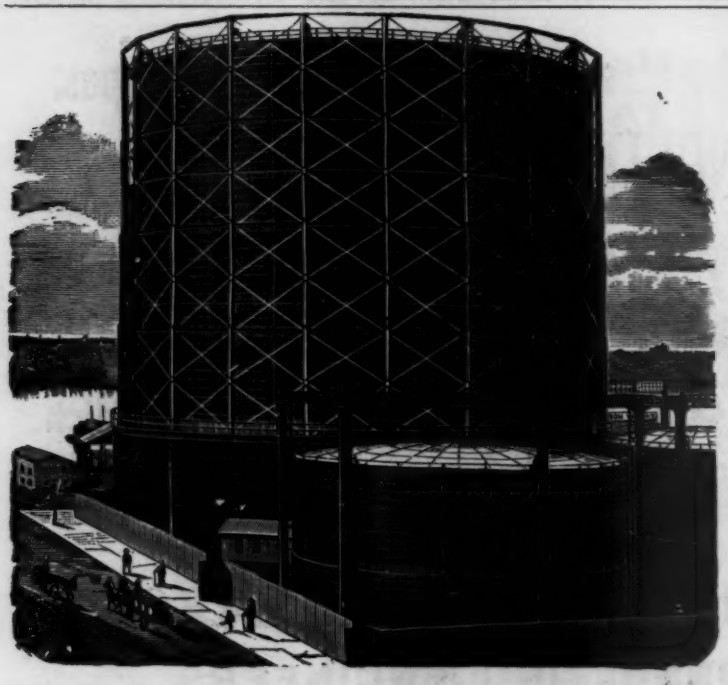

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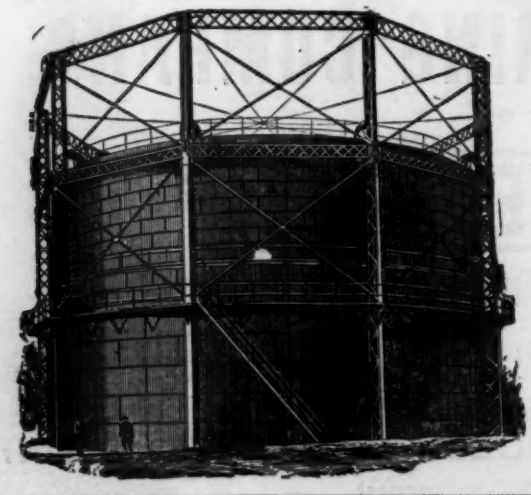

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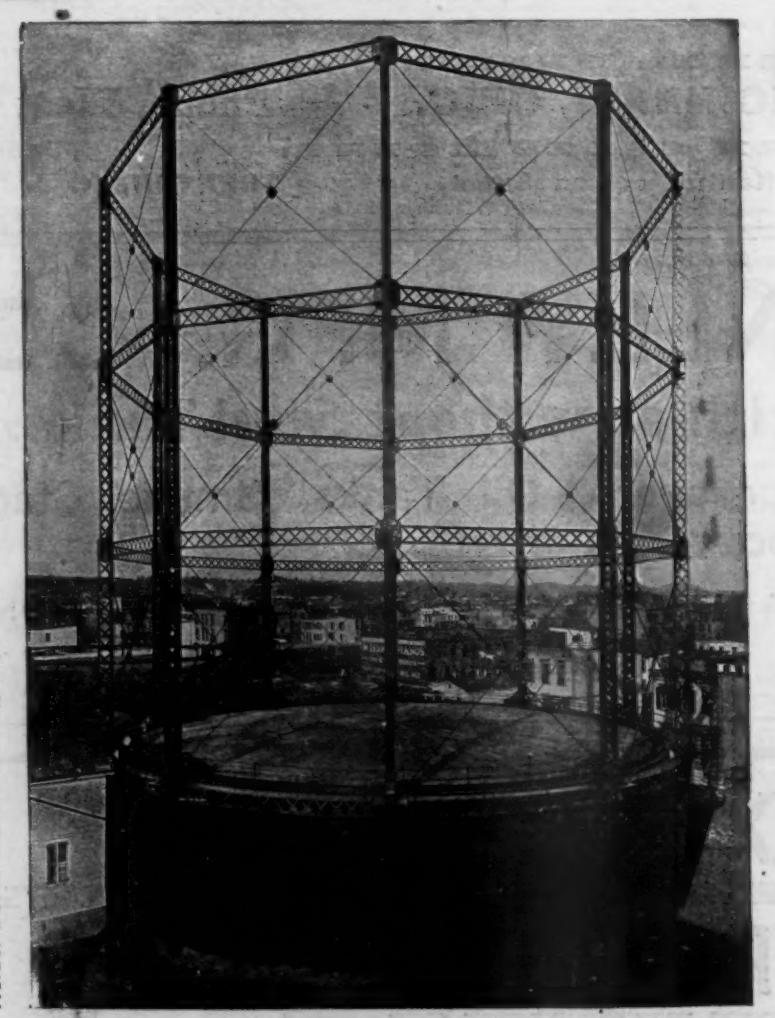

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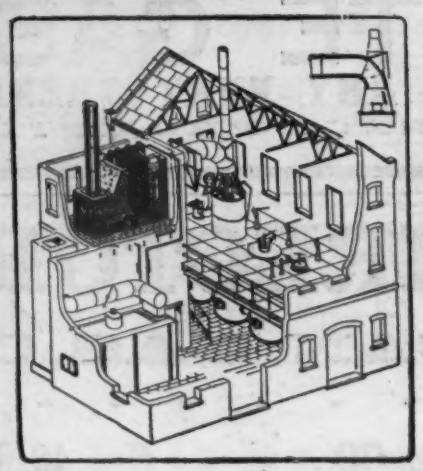

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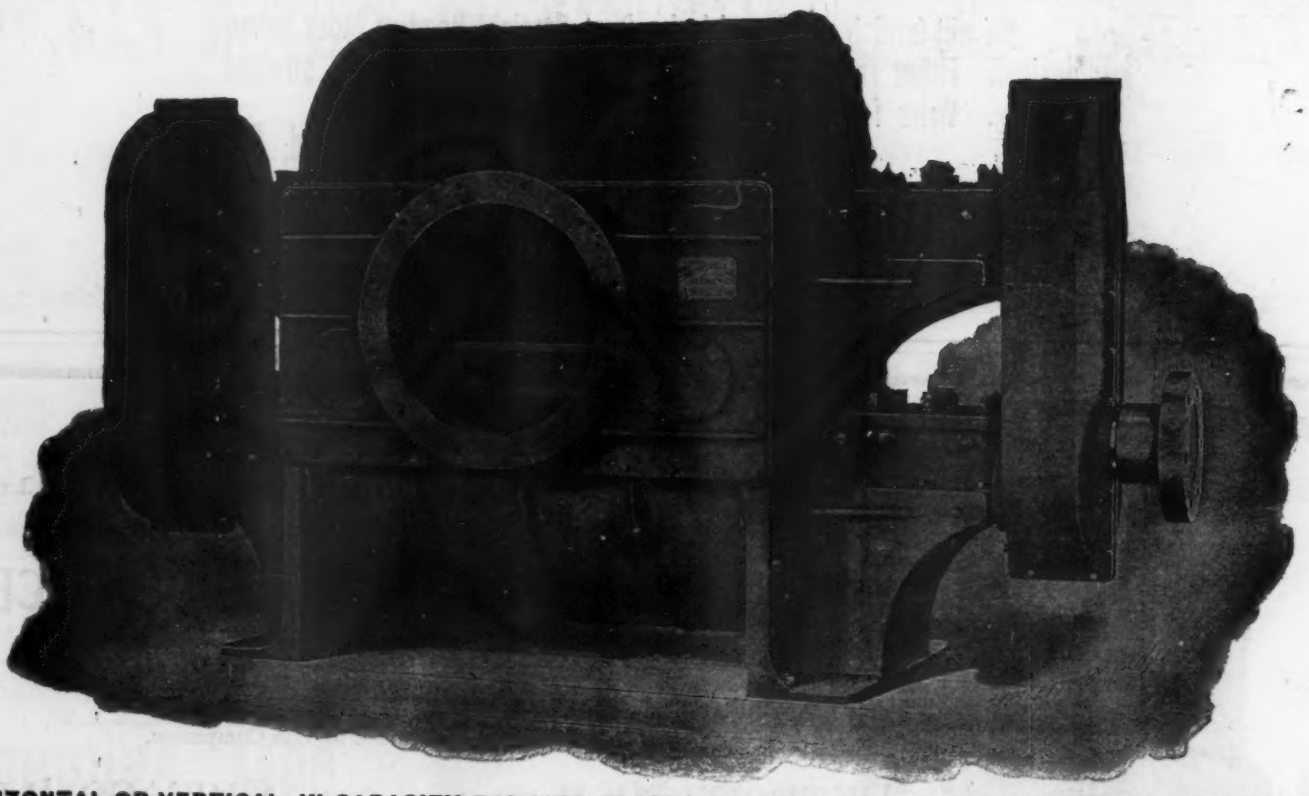

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